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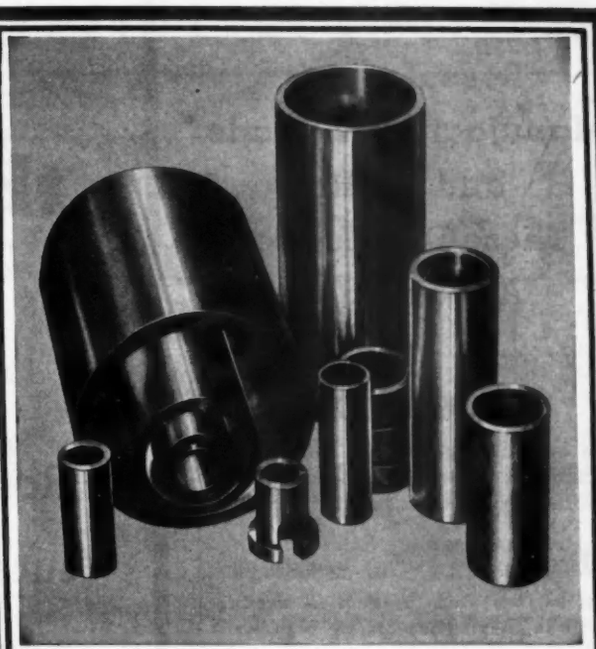

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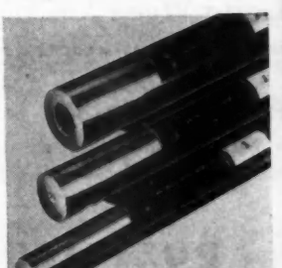

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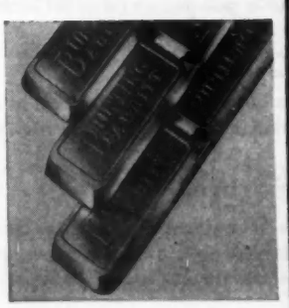

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Ross reduces parts-wear to a minimum.

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• Service

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AUTOMOTIVE INDUSTRIES

Vol. 72, No. 10 ▫ THIRTY-SEVENTH YEAR ▫ March 9, 1935

Boost March Goal to 425,000

Retail Orders Reported Still Ahead of Output

by Harold Gronseth
Detroit News Editor, Automotive Industries

Motor companies are working on a March production program which calls for an output by the industry of upwards of 425,000 cars and trucks, a slightly higher figure than indicated by schedules that were first set up. This is an increase of 20 to 25 per cent over the indicated February production which approximated 355,000 units on the basis of figures reported thus far by individual producers.

The big three of the manufacturers, Ford, General Motors and Chrysler, including all their divisions, will account for nearly 400,000 vehicles this month if present production plans are carried out. Barring interruptions in the form of labor troubles, the industry seems assured of establishing the biggest first quarter for production since 1929, nosing out 1930 by a small margin. The current quarter is headed for an output of 1,075,000 vehicles, which would compare with 749,532 units in the first three months of last year and with 1,046,689 in the first quarter of 1930.

Generally speaking the manufacturers have not been able to build up field stocks as they want them at this time of the year. In some cases dealers are adequately supplied for current sales, but little or no back log has been provided against the spring rush which is about due.

Despite increasing production, Ford still is far behind on orders for passenger cars, and trucks in dealers' hands are not yet up to the minimum quota, around 13,000, considered necessary by the company for display and demonstration purposes. Chevrolet production is rapidly gaining momentum but so far has made small inroads on the bank of unfilled orders. Chrysler divisions got off to an early start on current models and have dealers in better shape than most companies for the anticipated spring bulge in demand.

The fact that retail sales opened so strong right from the start of the year and have steadily gathered momentum with weather conditions in a great part of the country militating against sales, leads officials to conclude that with the coming of spring weather automobile

(*Turn to page* 345, *please*)

New LaSalle Out Soon

To acquaint the field force with details of the new line of LaSalle cars, soon to be placed on public display, more than 400 Cadillac-LaSalle distributors, retail sales managers and star salesmen will be guests of General Sales Manager J. C. Chick and other members of headquarters executive staff at a national meeting in Detroit, Monday and Tuesday, March 11 and 12.

APEM Costs Industry .0172% of Income

APEM income in 1934 amounted to .0172 per cent of the total income of the industry. In actual figures, the association's income last year was $88,360 against expenditures of $77,041, leaving a surplus from operations of $11,319.

The Dec. 31, 1934, balance sheet shows assets totaling $11,636 of which $8618 was cash and $2961 receivables. Liabilities include payables of $208, deferred credits of $2428, and a surplus from operations which the code authority holds as trustee of $9000.

The above figures are based on an audited report of Ernst & Ernst.

Feb. Output Tops Jan. By 17%, AMA Reports

February production was 17 per cent larger than in January and 48 per cent ahead of the same month last year, according to the Automobile Manufacturers' Association. The total was 355,350, a figure for that month which was exceeded only in 1924, 1926 and 1929.

In the first two months, it is estimated that production totaled 658,722 units for a gain over last year of 63 per cent.

Keller Appoints O'Neil General Mgr. of Dodge

K. T. Keller announces the appointment of William J. O'Neil as general manager of Dodge Brothers. Mr. Keller, who has been general manager of Dodge, continues as president of that company and also as vice-president and general manager of Chrysler Corp.

AFL Strike Vote Order Causes Little Stir Within Industry

DETROIT—Just as the skies were clearing in the automobile labor world, a new cloud appeared on the horizon when a strike vote was ordered by the National Council of United Automobile Workers Federal Labor Unions, affiliated with the American Federation of Labor. The vote to be taken by the union's 176 locals in automobile and automobile parts plants will require from two to three weeks to complete.

No serious concern, however, is felt among employers over this new threat. Some look upon it as window dressing for the Wagner bill, which the AFL strongly favors. Even if the locals vote to strike, it does not mean that a strike will be called. It only authorizes one. Final decision is up to AFL President William Green, who was chosen to act for the various locals and instructed by

(*Turn to page* 344, *please*)

Wage, Age, Employment Questions Answered by Cameron in Radio Talk

Is it true that men over 40 are discriminated against by automotive employers? Has machinery reduced the number of men needed to produce a car? And what about annual wages in the automotive industry?

Last Sunday night in a forceful broadcast that was plainly a reply to the Henderson report, W. J. Cameron answered these questions for the Ford Motor Co.

His answers to the first two questions were emphatically in the negative, pointing out that 40 per cent of those employed at the Rouge plant are over 40 and that it took 198.5 man-hours to build the 1934 Ford as against 191.8 man-hours for the 1929 model.

Hits Annual Models

In discussing the third question, he saddled the depression with responsibility, stating that there would be "no difficulty in providing continuous employment when business is normal." At the same time, he took a crack at the industry's annual model policy, stating that the Ford company did not know what unemployment was when model changes were less frequent.

Excerpts from Mr. Cameron's broadcast follow:

"First—there is not and never has been an arbitrary age limit in our shops. Long ago Mr. Ford laid down the rule that our payroll should represent a cross-section of the whole community. Whatever the percentage of any age group in the community, at least that percentage should be represented in our employment. That is the only age rule we have ever had, except, of course, the rule against child labor. We employ no one under 20 years of age. Employment figures for the month of February just closed show that in the great River Rouge plant with its 79,000 men, 40 per cent, or more than 31,000 men, are over 40 years of age. As a matter of fact, more than 8300 of them are over 50 years of age. (And this at a time when employment is curtailed, although it is much better than a few months ago.) Total Ford employment in and around Detroit shows that 41 per cent of our men are over 40 years old, 20 per cent are over 45 years, 10 per cent are over 50. This indicates that Mr. Ford's rule is being observed. Of course, we don't discriminate against young men, either—they have a right to their opportunity, but we do not foolishly deprive ourselves of the skill and experience that come with years. Low-age limits doubtless exist in some factories, but they are not the best factories.

"Now, as to the labor required to produce a car. We have never believed that machinery can render men obsolete. Our experience has been that when we improve our methods and machinery, it simply creates more jobs. If we devise a machine, as we have often done, by which five men can do more easily what 10 men did before, it does not put five men out of work, it usually makes jobs for still more men. True economy in operation—not pinchpenny economy, not cheap shortcuts, but true economy by better methods—means an improved product, a lower price to the customer, and in consequence larger sales and more men employed. That is the way it has worked with us for 30 years. We have steadily reduced the number of men needed on a given operation and steadily increased the total number of men in the shops. In 1929 for every Ford car produced, 191.8 hours of labor were used in our factory. Last year, 1934, it required 198.5 hours of labor—practically the equivalent of an additional eight-hour day per car, which means that more men were employed in the various departments of the business. The relation of man-power to production is pretty constant. The machine is man's helper, not his competitor. Machinery is a great factor in the increase of jobs and wages.

Annual Earnings

"The third question concerns continuity of employment. This, of course, everyone desires. Unemployment is unprofitable for all citizens regardless of their relation to industry. Some say employment could be made continuous by legislating an annual wage for workers. This, they imagine, would compel manufacturers to keep men at work. They must think it pays to keep shops closed! The Ford Motor Co. for many years did not know what unemployment was. In the slack season the factory was busy building up stock for the brisk season. But the annual model has altered all that. With frequent changes in style, stocks for the future cannot be accumulated. There are indications, however, that those who disrupted the continuity of work in the motor industry are growing tired of their new system.

"In spite of conditions, the amount of all-year employment in the Ford factories is surprising. Even when the Ford factory has stopped production, it still must keep 25,000 men at work every day. The 1934 figures for 29 of our shop departments employing over 12,000 men show that out of a possible 26 pay days in a year (we pay every two weeks) these men had 24 pay days. The highest year's wage in this group was $1,393, and the lowest, $1,026. An industry with a record like that in these times has no difficulty in providing continuous employment when business is normal."

Electric Traffic Lights for Indianapolis Track

A system of electrically controlled slow and go signals will be installed at the Indianapolis Motor Speedway to further increase the safety of the annual 500 mile classic staged each Memorial Day. The signal lights will be located at six strategic points about the track and when trouble occurs in any section the official in charge of that particular spot can immediately flash the caution signals to all the other parts of the speedway by merely pressing a button. Heretofore caution signals have been displayed by means of yellow flags displayed by track officials from word received through the field telephones.

Aaron DeRoy

Aaron DeRoy, Michigan distributor for Hudson Motor Car Co. and a leader in automobile dealer activities, was killed Friday, March 1, when his car overturned on a highway 15 miles north of Hartsville, S. C., while he was driving to Florida.

As president of the Michigan Automotive Trade Association and director and officer of the National Automobile Dealers Association, Mr. DeRoy was prominent in dealer affairs, being also chairman of the state advisory committee on enforcement of the motor vehicle retailing code, state code administrator and member of the national control and emergency committees. He was commodore of the Detroit Yacht Club and identified with all Great Lakes yachting activities. He was also a leader in philanthropic activities.

Born in Pittsburgh in 1880, Mr. DeRoy studied dentistry, but gave up his practice at age of 30 to enter the automobile merchandising field where he made early success. He moved to Detroit in 1923.

Mr. DeRoy is survived by his wife Helen, of the Whittier Hotel, Detroit, his parents who live in Pittsburgh, and two brothers and two sisters.

Feb. Output, Sales Fail to Bolster Stock Prices

Despite the increased production and sales of automobiles during February the market price of seven automobile stocks listed on the New York Stock Exchange declined 4.4 per cent in February from the aggregate market price at the close of business Jan. 31, according to Frazier Jelke & Co., brokers. The total market value of the stocks shown in the Jelke company's report at the close of business Feb. 28 was $1,552,747,000 comparing with $1,636,011,000 for Jan. 31, a decrease of $73,264,000.

Johns-Manville Corp.

A net profit for 1934 more than seven times greater than that earned in 1933 has been reported by the Johns-Manville Corp. For 1934 the net profit was $749,802, which compares with $105,331 for the previous year. The company's current position on Dec. 31 is shown in the accompanying tabulation.

	1934	1933
Current assets: (Inc. $3,359,786 cash)	$12,195,816	$11,882,079
Current liabilities ...	1,417,034	1,548,101
Working capital	10,778,782	10,333,978

NADA Moves to Get Facts for Use in Negotiations with NRA and Factories

To fortify itself with facts for use in dealings with Washington and with the factories, The National Automobile Dealers Association is requesting all dealers to send in carbon copies of their monthly statements. The association's department of industry statistics has been revamped to handle the data in order that current facts on profit possibilities in the trade developed from the statements will be immediately available.

It is planned to classify the information according to lines of cars, size of contracts, size of cities, states, districts, etc. The association says that the contents of the statements will never be revealed individually to anyone, but will be used to build up a combination statement regarding the trade in general.

In a bulletin announcing the program, which was sent to officers and directors of the NADA, chairmen and all members of state advisory committees and to secretaries of state dealer associations, President Vesper asks their cooperation in getting dealers to send in statements and urges prompt action as the data are needed now in negotiations going on for improvement in the dealer's position.

Germany Cuts New Vehicle Tax to Boost Oil Engines

Effective April 1, the German Government will reduce by two-thirds the tax on all newly registered oil-fueled trucks and omnibuses of more than 2½-ton capacity, according to the U. S. Commerce Department.

For old and new trucks using non-liquid fuels driven by steam, electricity, illuminating wood, and other gas, the tax has been reduced by one-half. This action is taken in order to encourage the purchase of new motor vehicles of domestic make and to stimulate further local manufacture, the report states.

Conn. T. & E. Receiver Dismissed; Loan Secured

The Connecticut Telephone & Electric Corp., Meriden, Conn., which has been operating under receivership for the past 30 months, has had the receiver discharged and through a Federal Reserve loan has been placed on a stable business basis with adequate financing facilities.

During receivership the factory was in continuous operation producing its line of automotive products consisting of motor vehicle direction signals and a complete line of automotive ignition parts, comprising coils, ammeters, oil gauges, switches, cut-outs, horn buttons, air plane terminals and other items. The most recent addition to the automotive line was Kwick-Start, an attachment to facilitate engine starting in cold weather by means of a secondary electric current supply delivered to the spark plugs with high voltage during the period the electric starter is rotating the engine crankshaft.

Small Towns' Percentages of Car Sales Gain Doubled Larger Centers in 1934

The percentage increase in passenger car sales in 1934 over 1933 was more than twice as large in towns of 10,000 and less population, as in communities of more than 10,000 people, the *Household Magazine* reports on the basis of data supplied by R. L. Polk & Co.

Last year the small town market absorbed 833,163 new cars as compared with 602,338 in 1933 for a gain of 38 per cent. This contrasts with an increase of only 18 per cent in cities of over 10,000 where sales rose from 891,509 to 1,035,394.

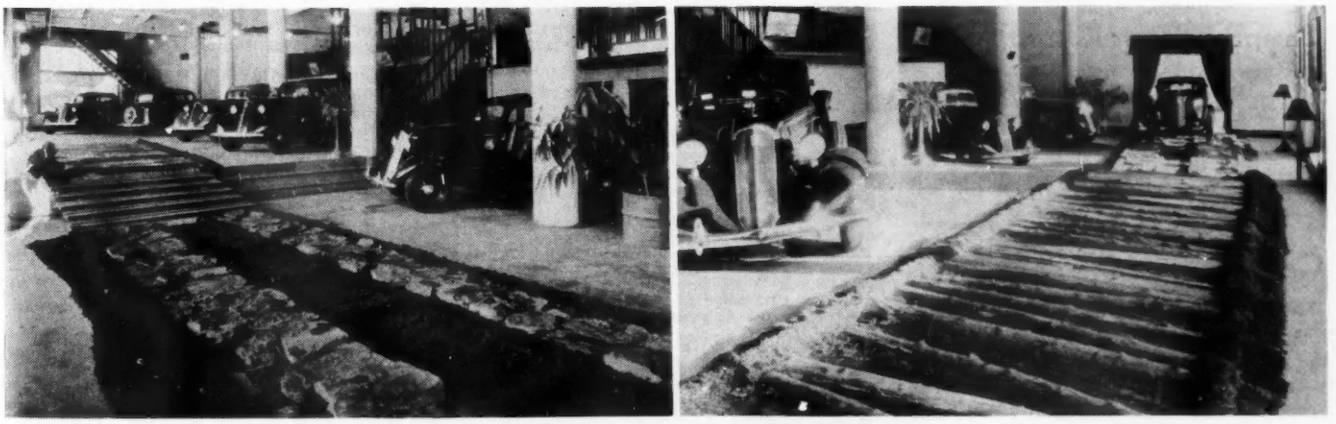
According to the Chilton Trade List, the number of small town outlets increased 8 per cent from 33,667 in 1933 to 36,491 in 1934, as compared with a five per cent increase in cities of more than 10,000, the respective 1933 and 1934 figures being 16,-361 and 17,111.

The number of units sold per small town outlet rose from 17.9 in 1933 to 22 8 in 1934, an increase of 27 per cent. In the over 10,000 group, the number of units sold per outlet increased only from 54.4 to 61.6, or 13 per cent. The larger increase in volume enjoyed by the small town outlets may have been a factor of some importance in the better profit showing such dealers had last year in comparison with dealers in larger cities.

However, the improvement in rural purchasing power last year almost certainly was responsible to a major degree for the better showing of the small towns. This is borne out by the fact that the small towns showed the smallest increases in the northeastern section of the country where most of the big cities are located and where industry is a more important element in the economy of the states.

The following table shows how the increases were distributed geographically:

	Per Cent Increases, 1934 over 1933	
	10,000 and under	Over 10,000
New England	15	13
Middle Atlantic	25	1.2
East North Central..	33	28
South Atlantic	54	27
East South Central..	65	26
West North Central.	44	18
West South Central..	41	27
Mountain	84	46
Pacific	33	18
United States.....	38	18



This "third degree" road test was built in the show rooms of the Beach Motors, Ltd., Ottawa, Ont., to demonstrate Studebaker's "miracle ride." Snow and ice on the streets prevented outside demonstrations.

AMA Refuses Green Request for Conference; Scores AFL Tactics

NEW YORK, March 7—"This association is not itself an employer of automobile workers and has no occasion to carry on collective bargaining," Alfred Reeves, vice-president of the Automobile Manufacturers Association, today wrote William Green, president of the American Federation of Labor, in response to the latter's letter of Feb. 27 requesting a conference with the manufacturers.

The AMA, Mr. Reeves said in his reply, "does not arrange such conferences as you suggest. The manufacturers, members of this association, bargain collectively with their respective employees through representatives of their employees' own choosing, in accordance with the settlement made by the President of the United States on March 25, 1934, and in accordance with the law.

"The manufacturers are in regular negotiation with the bargainig agencies which their respective employees have elected in accordance with the law and with the President's settlement. They will doubtless meet other representatives as well when such representatives show the proper authority from the employees who have chosen them and indicate the matters they desire to discuss."

Mr. Reeves then characterized charges made by F. J. Dillon, Detroit organizer for the Federation, of conspiracy, coercion, intimidation and the existence of company-controlled unions as false and unfounded. He stated further that the AMA considers the Federation's withdrawal from the President's settlement and its authorization of a strike vote, as unprovoked aggression against the industry's employees, and that since members of the A. F. of L. represent only a small minority in the industry, it has no just claim to be spokesmen for automobile workers generally.

Campbell Boosts Record

A new world's mile speed record was set by Sir Malcolm Campbell on Thursday of this week when he drove his Blue Bird over Daytona Beach sands at an average speed for runs in each direction of 276.816 m.p.h. The previous record, also made by Sir Malcolm, was 272.108 m.p.h.

Court Adjournment Delays Spielman Case Argument

Arguments before the Supreme Court in the Speilman Motor Sales Co. case are expected to be made next week. They had been tentatively scheduled for presentation this week but did not reach the court whose calendar was delayed somewhat by reason of adjournment taken Wednesday owing to the death of the late Justice Oliver Wendell Holmes. The court met again Thursday and adjourned until Monday in order that members could attend funeral services for Justice Holmes.

Previously the court had denied a motion for further postponement of the hearing made by William C. Dodge, New York County District Attorney, and scheduled the hearing for this week. Mr. Dodge asked the court to hear the case along with several others affecting New Deal legislation.

Brussel Appointed Works Manager of Federal-Mogul

J. W. Brussel, formerly works manager of Timken-Detroit Axle Co., has been appointed works manager for Federal-Mogul Corp. Mr. Brussel was connected with Timken for over 10 years and for the past year was vice-president of the Wolverine Machine Co. of Detroit.

Jarman Joins NSPA

Ross Jarman who has been in the automotive industry since its inception, has been added to the field organization of National Standard Parts Association, it is announced by E. P. Chalfant, executive vice-president.

Mr. Jarman is widely known among manufacturers and jobbers through his work over a period of 14 years with Champion Spark Plug Co. and Ray Day Piston Corp.

Charles H. Burr

Charles H. Burr, one-time treasurer of SKF, and for many years a director and officer of MEMA, died March 5 at his home in White Plains, N. Y.

Thomas Leaves Reo

Horace T. Thomas, one time vice-president, director and chief engineer of the Reo Motor Car Co., has retired from the company effective March 1. After a vacation

Horace T. Thomas

in Florida, he intends to return to the automotive engineering field.

On his graduation from Michigan State in 1901, Mr. Thomas went to work for R. E. Olds as chief engineer of Oldsmobile. Subsequently in 1904, when Mr. Olds launched Reo, Mr. Thomas went with him as chief engineer and was the first man on the payroll of the new company. He is credited with having designed and made the drawings for the first Reo cars and later with such developments as the Speed Wagon, trucks on pneumatic tires, and the herringbone gear and the automatic transmissions used by Reo in recent years.

Eaton Mfg. Co. Building Detroit Plant Addition

An addition to the Detroit plant of Eaton Manufacturing Co. is under construction, which will bring the total floor area of that plant to 157,600 sq. ft. Within recent months leaf spring production facilities have been increased by the installation of two complete production units, three tempering furnaces, three draw fires and several taper rolling machines.

Harry Dunn

Harry Dunn, vice-president in charge of purchases of the Auburn Automobile Co., died Friday, March 1.

Summary of Labor Group Affiliation Votes Through March 5, 1935, in the Nominating Elections for Representatives of Employees in 25 Automobile Plants

	Flint Chevrolet Plant	Olds Works, Lansing	Totals Through Mar. 5, 1935	Percentage of Total
Unaffiliated	8,880	1,966	77,667	73
Employees Associations	1,007	357	11,611	11
Associated Automobile Workers of America	9	1,830	6,070	5¾
American Federation of Labor	1,363	114	5,403	5
Mechanics Educational Society of America	12	1	519	½
Association of Certified Welders	...	0	36	....
Auto Workers Union	3	0	37	....
Society of Designing Engineers	2	2	19	....
Auto Service Mechanics Association	...	0	16	....
International Workers of the World	6	0	24	....
Dingmens Welfare Club	...	0	7	....
Pontiac Chamber of Labor	...	0	4	....
International Association of Machinists	...	0	1	....
Blank Ballots	598	16	2,124	2
Void Ballots	364	52	2,317	2
Total ballots cast	12,244	4,338	105,855	
Total eligible voters	13,878	5,178	122,854	
Per cent of eligible voters who voted	88	84	86	
Total eligible voters working on the day of the nominating elections	13,557	4,991	117,143	
Per cent of those working who voted	90	87	90	

H. O. Ward

Faulkner Visits Florida Distributors, Dealers

Roy H. Faulkner, president of Auburn, is touring Florida cities, contacting Auburn distributors and dealers. He plans to spend about 10 days in the state going by motor from West Palm Beach to Miami, St. Petersburg, Tampa, Orlando, Daytona Beach, St. Augustine and Jacksonville. Recently Mr. Faulkner completed a 10,000-mile business trip from Maine to California.

Guy H. Billings

Guy H. Billings, 45, assistant general manager and purchasing agent, of the Four Wheel Drive Auto Co., died recently in the waiting room of his physician's office, while awaiting treatment. Mr. Billings joined the Four Wheel Drive Co. in May, 1913, and began work in the accounting department. In February, 1915, he was made purchasing agent of the then newly created purchasing department.

Mr. Billings was born in Omro, Wisconsin, March 13, 1890. He is survived by his wife and son, a student in the Clintonville High School.

Perfect Circle Building New $60,000 Warehouse

Ground was broken at Hagerstown, Ind., several days ago for a new warehouse and shipping building, officials of The Perfect Circle Company report.

The new building, which will cost approximately $60,000, is one of the last units of an extensive building program. The structure will be 100′ x 100′ and constructed of reinforced concrete with brick curtain.

Ward Directs Chrysler Export Advertising

H. O. Ward, for five years advertising and sales promotion manager of the Chrysler Export Corp., has been appointed director of advertising and sales promotion of the new export division of the Chrysler Corp.

Enlargement of the facilities and the scope of the work of the export advertising department have become necessary through the increase in Chrysler overseas shipments within the past three years. Sales of the division are said to have trebled in that time. The department which Mr. Ward heads is one of the largest in the automobile industry. It comprises a translation staff of nearly 20 people and a complete copy, production and research staff. Mr. Ward has been with the Chrysler Corporation for over seven years. Previous to joining the Chrysler organization, he was in the advertising agency business in Detroit.

Studebaker Board Meeting Rumored

Hoffman to be President, Vance Chairman of Board Previous Indications Hint

NEW YORK, March 7—It is reliably reported that the first meeting of the board of directors of the reorganized Studebaker Corp. will be held tomorrow (Friday, March 8) when election of officers will take place. It has been previously publicized that Paul G. Hoffman would be president, and H. S. Vance chairman of the board and presumably election of these officers will take place. The election of four new vice-presidents, all men who have long been with Studebaker, is expected.

The New York Stock Exchange's governing committee approved on Wednesday the listing of Studebaker Corp. six per cent convertible debentures due 1945 and common stock of $1 par value being issued in reorganization of the company. Trading in new Studebaker shares is expected to begin early next week, possibly Monday.

Pouliot New Wholesale Code Authority Head

Aime E. Pouliot of the National Bushing and Parts Co., Minneapolis, was elected president of the Code Authority for the wholesale automotive trade at a meeting of the Code Authority March 1 in Washington, D. C. Mr. Pouliot is also president of the Northeast Automotive Wholesalers Association and has been prominent in NSPA activities. He succeeds R. G. Patterson of Indianapolis, who was elected secretary.

The other new officers are: W. N. Potter, Detroit, first vice-president; J. F. Creamer, New York, second vice-president and Ralph W. Boozer, Indianapolis, treasurer.

Frank G. Stewart, Washington, D. C., was continued as executive secretary. The officers of the Code Authority and Tom Glasgow, Charlotte, N. C., comprise the executive committee.

Code Unnecessary if Factory-Dealer Relations Are Right MATA Believes

Expressing the belief that factory-dealer relationships can be put on a plane that would make code regulation unnecessary, H. H. Shuart, secretary of the Michigan Automotive Trade Association, has written the car manufacturers forwarding a resolution adopted by that organization's directors which requests a conference between committees representing respectively the car makers and the dealers. In the interests of the entire industry, the resolution states, such a conference should be held as soon as possible to determine a future course which will strengthen the workable and justifiable provisions of the dealer code and eliminate the unsound and unworkable provisions.

In his letter, Mr. Shuart says:

"We come to you on the premise that the automobile dealer is your agent and that your contractural relationships are matters which must be adjusted between you without influence or pressure.

"Nevertheless, the present code is proof of the fact that a large percentage of the dealers in the United States felt that outside control was necessary to assist them in making the profit to which they believe they are entitled. None of us knows the future of NRA, but it is our opinion that there would be no necessity for a code if the manufacturer and the dealer could both approach this subject on a basis of understanding and confidence and bring out of it a relationship which would accomplish the justifiable provisions of the code without Government aid or interference and without the enormous expense involved in the present set-up.

"From the standpoint of an association executive, I personally feel that we have been taking an expensive ride on a merry-go-round and that the whole situation is one which could be efficiently and satisfactorily handled, in a short time, if selfish motives could be set aside and men of impartial view and sound judgment would take the problem in hand."

Myers Grants Wage Rise and Signs AFL Contract

Operations were resumed at the Myers Regulator Co. plant in Toledo last Tuesday following settlement of a 13-day strike by terms of which minimum wages for women were set at 37 cents and men 47 cents per hour.

Seniority rights, 40-hour week and 1½-time for all over 40 hours in a week were other concessions granted by the management in a contract signed with United Automobile Workers Federal Union No. 18,384.

A Correction

In the description of the ninth edition of the Chilton Flat Rate Manual which appeared on page 320 of the March 2 issue of *Automotive Industries* the price of $5 was quoted. This is incorrect, the price is $6.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

General business activity held up quite well last week, although there was a moderate slackening in the heavy industries. There was a further slight decline in steel operations. Lumber production was the largest for any week this year, and shipments and new orders were the second highest. Retail business continued active, but it was adversely affected by the changeable weather. Merchants are anticipating the best spring business in five years.

Car Loadings Slump

Railway freight loadings during the week ended Feb. 3 totaled 552,896 cars, which marks a decrease of 29,085 cars below those during the preceding week, a decline of 22,012 cars below those a year ago, and an increase of 90,581 cars above those two years ago.

Chain Store Sales Falter

Sales of chain stores during January showed a greater than seasonal decrease. Gains were reported by a few companies, but business as a whole was not so favorable as in the few months preceding. Five-and-ten cent stores suffered the most, with sales below those in the corresponding month last year.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended Feb. 27 showed no changes in holdings of discounted bills, of bills bought in the open market, and of government securities.

Crude Production Slackens

Average daily crude oil production for the week ended Feb. 23 amounted to 2,536,200 barrels, as against 2,567,500 barrels for the preceding week and 2,226,050 barrels for the corresponding period last year.

Bituminous Mining Steady

Production of bituminous coal during the week ended Feb. 16 totaled 8,515,000 tons, which is slightly below the figure for the preceding week and compares with 8,015,000 tons during the corresponding period last year.

Fisher's Index

Professor Fisher's index of wholesale commodity prices during the week ended March 2 stood at 82, as against 82.2 the week before and 82.4 two weeks before.

Current Output Gains

Production of electricity by the electric light and power industry in the United States during the week ended Feb. 23 was 5 per cent above that in the corresponding period last year.

Motor Needs Sustain Capacity Sheet Flow

Little Concern Felt Over Possible Cancellations Through Labor Troubles

Steel buyers as well as sellers have become so inured to clouds in the market's firmament that unless the downpour starts forthwith umbrellas are shunned. Not so very long ago the airing given in the last few days to efforts on the part of union radicals to cause trouble in the automobile industry would have caused steel mill owners to worry about the possibility of sudden cancellations.

To-day no one, either on the buying or selling side of the market, is paying the slightest attention to these incidents. Nor is there in the steel industry any uneasiness in evidence over the possible outcome of the fracas between the Federal Trade Commission and the National Industrial Recovery Board on the subject of the "basing point" system. Not even Washington reports that the President might turn the problem over to Congress have been given more than passing notice in the steel market.

Non-integrated sheet rolling mills have been buying semi-finished steel in hand-to-mouth fashion of late, but in not a few cases extreme caution on the part of this class of producers is ascribed to their uneasiness over where the race for more and more automatic equipment will lead to and whether, once this enormous increase in rolling capacity makes itself fully felt, mills having higher production costs, will be able to stay in the ring.

Certain it is that this week's rate of ingot production is higher than during the preceding week, the American Iron and Steel Institute reporting 48.2 per cent of capacity engaged, as compared with 47.9 per cent in the preceding week, and certain it is also that finishing mills are maintaining their previously high rate of operations, amounting in the case of automobile sheet producers to virtually 100 per cent of capacity.

Pig Iron—Middle West markets report a continuance of gratifyingly good takings by automotive foundries. In Cleveland about 5,000 tons were ordered for March delivery by automotive foundries. Prices are unchanged all along the line.

Aluminum—Fairly active at unchanged price levels.

Copper—The first parley of the world's copper producers, with a view to arriving at orderly marketing conditions in all consuming centers, is scheduled for Friday of this week. Domestic consumption in February was the best in nearly a year, aggregating 29,500 tons. Prices are unchanged.

Tin—While the price of tin recovered moderately at both Singapore and London, lower Sterling exchange caused further recession, Spot Straits tin being quoted at 47.35 cents at the beginning of the week, compared with 47¾ cents at the preceding week's close.

Lead—Moderately active and unchanged.

Zinc—Quiet and unchanged.

Idaho, Ind., Bills Would Regulate Private Trucks

What the National Highway Users Conference describes as the first serious step toward "cracking down" on private motor vehicle operation appears in two bills, one introduced into the Indiana legislature and the other in the Idaho legislature. Both bills would place privately operated cars or trucks used in private business under the control of public service commissions, railroad commissions, or other authorities in charge of vehicular regulation.

Under the provisions of the Indiana bill the Public Service Commission would be empowered to designate highway routes over which such vehicles may or may not operate and the times when such vehicles may or may not operate. This bill also provides a registration fee of $30 per vehicle. The Idaho measure provides for the registration of all such vehicles and the issuance of a special marker by the Public Utilities Commission for the purpose to which the vehicle is to be put, and also gives the commission the power to investigate and prosecute any cases of exempted vehicles being operated for any purpose for which a marker has not been issued. Exempted vehicles are those operating wholly within municipal limits, school buses, government-owned vehicles and agricultural trucks.

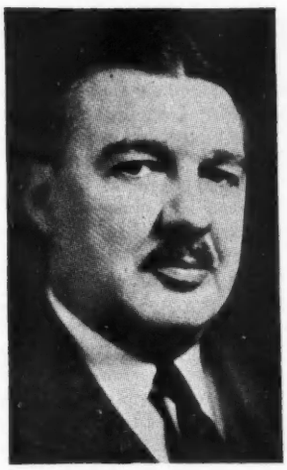
Gemmer Mfg. Co.

The Gemmer Manufacturing Co. reports a net loss of $13,047 for 1934 against $32,117 for 1933. Comparative assets and liabilities are shown in the following tabulation:

	1934	1933
Current Assets	$742,154	$673,983
Current Liabilities	138,835	80,344
Working Capital	603,319	593,639

Correction

On page 248 under Automotive Diesel and Other Heavy Oil Engines table, which appeared in the Statistical Issue of *Automotive Industries*, the weight per Rated Horsepower of the Continental D2 Engine was shown as 61.5 lbs. This should be corrected to read 6.15 lbs.



T. J. Campbell

newly elected president and general manager of Berry Brothers, paint manufacturers. Formerly Mr. Campbell was vice-president and general manager of the concern

Hauck Joins Lukens Steel as President's Assistant

W. A. Hauck has been appointed assistant to the president of Lukens Steel Company, Coatesville, Pa. Prior to joining Lukens, he was with the American Iron and Steel Institute, engaged in work in connection with the code of the iron and steel industry.

Traffic Problem Solution is Better Enforcement, Not More, Hoffman Says

Solution of the twin problems of traffic accidents and highway congestion lies, partially at least, in better enforcement of traffic regulations rather than more enforcement, Paul G. Hoffman, Studebaker Sales Corp. president and chairman of the AMA Traffic Safety Committee, told the delegates attending the sixth annual Greater New York Safety Conference in a paper which was read by Norman G. Shidle.

In his paper Mr. Hoffman cited five "don'ts," which he believes are desirable in the promotion of traffic safety. They are: Don't have temporary "safety drives" or "rodeos" during which time everyone is arrested for everything; don't have a court system where a two dollar fine is accompanied by a half a day's wait in court; don't make technical arrests for going one mile per hour over an arbitrary speed limit when no hazard is involved; don't make arrests for "three in the front seat" when there is plenty of room in modern cars; don't make arrests for revenue purposes.

Mr. Hoffman went on to explain in his paper that the "enforcement cart is before the horse" in many localities and pointed out that in many instances no punishment is meted out to a man going 40 miles per hour and causing an accident, while a man who does drive 40 miles an hour when there is no hazard involved is often punished. The Studebaker official suggested "accident investigation" as a remedy for this situation. He also stated that in his opinion the arresting of hundreds of thousands of motorists for technical violations only builds up a resentment which will eventually prevent the entire program of traffic law enforcement from operating properly. Special attention should be given to "repeaters," Mr. Hoffman suggested, those motorists who commit the most of the traffic law violations and cause most of the accidents. An accurate filing system would aid in this work, he said. Mr. Hoffman concluded his paper with a discussion of the tests to which modern automobiles are subject to insure their mechanical safety.

Gasoline Consumption Gained 7.63% in '34

Total gasoline consumption for 1934 was 16,617,050,000 gals. compared with 15,438,324,000 for 1933, according to the American Petroleum Institute. This represents a gain of 7.63 per cent for last year. December consumption was 1,288,463,000 gals., which compares with 1,415,547,000 for November and 1,169,089,000 for December, 1933. The December, 1934, consumption is an increase of 10.21 per cent over the preceding month.

January Passenger Car Export Total 3 Times '34 Volume; Value Gains 59%

Exports and Imports for the Automotive Industry for 1935-1934 January

	1935		1934	
	Number	Value	Number	Value
Automobiles, parts and accessories	....	$17,208,344	....	$10,841,597
Motor trucks, buses and chassis (total)	6,591	3,417,353	7,573	3,304,397
Under one ton	434	155,105	535	146,600
One and up to 1½ tons	4,979	2,273,977	6,339	2,485,364
Over 1½ tons to 2½ tons	1,028	777,635	553	498,750
Over 2½ tons	122	197,705	126	166,518
PASSENGER CARS				
Passenger cars and chassis	11,035	6,563,737	3,685	2,477,813
Low price range $850 inclusive	9,997	5,361,957	3,049	1,725,967
Medium price range over $850 to $1,200	692	657,821	357	343,380
$1,200 to $2,000	147	235,798	120	205,877
Over $2,000	109	273,529	65	170,827
PARTS, etc.				
Parts except engines and tires	....	.....	....	.....
Automobile unit assemblies	....	4,554,343	....	2,854,522
Automobile parts for replacement (n.e.s.)	....	1,895,889	....	1,593,091
Automobile accessories (n.e.s.)	....	207,297	....	175,184
Automobile service appliances	....	188,028	....	142,746
Airplanes, seaplanes and other aircraft	26	1,083,062	20	173,140
Parts of airplanes, except engines and tires	....	361,030	....	105,690
INTERNAL COMBUSTION ENGINES				
Stationary and portable:				
Diesel and semi-Diesel	53	59,921	24	49,433
Other stationary and portable:				
Not over 10 hp.	1,051	49,870	221	22,108
Over 10 hp.	97	80,617	52	75,691
Automobile engines for:				
Motor trucks and buses	114	25,474	192	33,372
Passenger cars	2,110	135,623	1,697	98,213
Aircraft	32	111,196	72	334,544
Accessories and parts (carburetors)	....	105,718	....	90,060
IMPORTS				
Automobile and chassis (dutiable)	40	25,089	40	7,698

Swartz Joins Cleveland Bronze Research Staff

Dr. Carl E. Swartz, physical metallurgist, has been added to the staff of the research department of the Cleveland Graphite Bronze Co., according to Ben F. Hopkins, president. For the past nine years Dr. Swartz has been associated with the research department of the American Smelting & Refining Co. and is said to be a co-inventor of the cadmium-nickel alloy which has attracted attention in automotive circles.

Car Upholstery Makers Granted Extra Work Hours

Manufacturers of mohair velvet said to be used to upholster 80 per cent of this year's cars, have been granted an extra 40-hour shift up to and including May 18 by the NRA to meet the automotive demand for the material.

Cincinnati Ball Crank Co.

A net loss for 1934 of $76,405 against $85,912 for 1933 has been reported by the Cincinnati Ball Crank Co. The company's Dec. 31 balance sheet shows the following current position:

Current Assets	1934	1933
(Inc. $71,949 cash)	$267,782	$286,095
Current Liabilities	21,980	25,487
Working Capital	245,802	260,608

" . . . We are not talking strike"

William Green, left, AFL president, and Francis J. Dillon, right, AFL organizer in Detroit. The photograph was made when Mr. Green recently visited the motor capitol to drum up AFL memberships.

Little Stir Caused by AFL Strike Vote Order

(*Continued from page* 337)

them to seek immediate conference with motor officials. He has notified the Automobile Manufacturers Association of his appointment as spokesman for the UAW and has asked for a conference. It was to clothe Mr. Green "with power necessary to enforce demands" that the council authorized the strike vote.

In its official notice to members, the national council cautioned against unauthorized action by individual locals, and set up strict rules for balloting. Some saw in the language used a lack of determination to go through with a strike. Only members in good standing are permitted to vote and a secret ballot is being used. A three-fourths majority is necessary to vote a strike, and finally it must be sanctioned by Mr. Green.

It is considered quite probable that union members will give Green their support by voting him the discretionary power he asks to call a strike if he deems it advisable. But since the Automobile Labor Board elections have shown what a small minority of the workers are represented by the AFL, their vote cannot be taken as indicative of the attitude of the mass of workers.

The Federation has been unable to raise its percentage in labor elections beyond 5 per cent. Of course they claim that they asked their members not to vote, but if they were given all the eligible non-voters they still would account for only around 19 per cent of the total workers. The UAW claims a membership of 20,000, but there are between 400,000 and 500,000 workers in the automobile and parts industry. Union headquarters in Detroit report substantial gains in membership of all locals in this area as result of intensified efforts put forth in connection with Green's tour of automotive centers. Their claims, however, are scouted by outside observers who are keeping tab on the union's progress. They say that mass meetings called by the AFL have not been well attended.

Locals have been warned not to reveal to the public the result of their strike vote but to report immediately to the AFL headquarters in Detroit which will not announce results until all reports are in.

In view of its poor showing in the ALB elections, it is considered doubtful if the AFL will attempt to call out their membership in all plants. What is more likely, if it comes to extreme measures, they may order walk-outs in a few key parts plants where they are generally conceded to have greater strength. But even this strategy does not hold any great promise of success. Such sniping could easily discommode the industry, but there is not the danger of a serious tie-up that existed a year ago. After that experience the manufacturers have been more careful not to put all their eggs in one basket.

In his letter to Alfred Reeves, AMA vice-president, requesting a conference with automobile manufacturers Mr. Green says, "It must be clearly evident that the automobile manufacturing industry has passed from the point of individual worker and management relationship to the time and period which calls for the establishment of a collective relationship between automobile workers and automobile managements.

"Stability, cooperation, and a constructive relationship can be established between the workers and management in the automobile industry through development of collective bargaining processes through which agreements covering fixed periods of time may be negotiated and signed. The American Federation of Labor is committed to the principle of collective bargaining and the consummation and observance of wage agreements. Please be assured," says Mr. Green, "that in requesting a conference with the automobile manufacturers affiliated with the AMA, I am inspired by a sincere desire to establish a genuine cooperative relationship between workers and automobile management and to promote and advance the cause of industrial peace."

The recent strike of maintenance men at the Murray Corp. hit a key spot, but it failed. The men were replaced and the strikers are unemployed. Similarly the walk-out at the Lansing plant of Fisher Body Corp. also failed, the men being replaced. Both strikes caused only slight interruptions to operations. These, perhaps, may not be considered tests of union strength since in both instances action was taken independently by the locals without the blessing of AFL headquarters, which however, later came to their support. No doubt the union is in a position to strike more telling blows in the industry.

The Myers Regulator Co. plant in Toledo, which makes a window regulating device for Chrysler Corp., ran into difficulties when officials attempted to break a 12-day strike by using non-union workers. A riot occurred which resulted in many arrests and some property damage.

Results of the Fisher Body election in Lansing surprised observers who had been led to believe the AFL was unusually strong there. The Federation garnered only 383 of the 2,607 votes cast, 1,684 been unaffiliated. At the Olds election, unexpected strength was displayed by the Associated Automobile Workers of America, an independent union, which nominated its candidates in 10 out of 14 districts, accounting for 1,830 votes against 1,943 for unaffiliated and 114 for the AFL. Combined vote of the three Lansing plants, Olds, Reo and Fisher, showed the AFL trailing with 630 out a total of 9,163 votes cast. Unaffiliated ballots totaled 4,722 and the AAW polled 1,959 to lead the unions. Company employee associations received 1,579 votes.

The National Council bulletin authorizing the strike vote breathed belligerence. It was bitterly critical of the employers, the Government and the Automobile Labor Board. "Never before," the bulletin charged, "has so large a group of workers within our country been compelled to toil under such intolerable conditions. . . . The employer has consistently opposed any relief. . . . Our appeal to the Government has failed to bring relief. . . . Our resort to governmental agencies has provided only the impossible conclusions of a reactionary college professor and a repudiated labor man. . . . To remain docile . . . would mark the automobile employee as one devoid of either character or courage. . . . The die has been cast. . . . The automobile worker now has the opportunity of striking the blow which will bring to him freedom and justice. . . ."

Trico Products Corp.

Trico Products Corp. reports a net profit of $1,771,559 for 1934 compared with $1,418,277 for 1933. The company's current position on Dec. 31 was:

	1934	1933
Current assets (Inc. $592,156 cash) ..	$6,998,214	$5,785,311
Current liabilities	1,078,863	779,055
Working capital	5,919,351	5,006,256

Boost March Goal to 425,000

(*Continued from page* 337)

dealers will experience a volume unparalleled since 1929. If these expectations are realized it will mean that production will mount accordingly and will continue at a high rate through the spring months since there are no heavy stocks from which to draw.

Evidence of expanding retail sales is found in reports of Dodge dealers who during week ended March 2 delivered 5,762 Dodge and Plymouth passenger cars and 965 Dodge commercial cars and trucks, a total of 6,727 vehicles against 6,156 in the preceding week. The increase over corresponding week of 1934 was 73.1 per cent. Up to March 2, Dodge dealers have delivered 45,789 vehicles against 25,128 in like period last year, an increase of 82.2 per cent.

Used car sales also are showing gains, the total for the week of March 2 being 5,968 units or 177 more than in preceding week and 2,410 ahead of corresponding week last year.

Plymouth retail deliveries for the week ended March 2 totaled 7,260, an increase of 4.4 per cent over the preceding week and 43 per cent over the corresponding week last year. Plymouth's shipments during the first two months of 1935 totaled 91,341 compared with 52,185 in like period 1934, a gain of 75 per cent.

Before the end of the current month, DeSoto shipments will pass the entire 1934 total of 13,861. Including December shipments of 1935 models, the total up to March 1 was 9,528 which compared with only 615 cars shipped at the corresponding date a year ago. During the week ended March 2, DeSoto dealers delivered 485 cars or more than for first nine weeks of 1934. The company is offering two lines of cars this year while in 1934 it had only the Airflow cars which were slow in getting into production. Retail deliveries of both lines up to March 2 totaled 2,940 against 447 Airflow cars for like period in 1934.

With production of 16,327 cars in February, Pontiac broke all monthly records since 1929. February retail deliveries of 10,732 cars was the biggest volume in six years comparing with 7,375 cars in January this year and 4,361 cars in February last year. Unfilled orders for Standard Six models increased 18.2 per cent during the month. Pontiac's March production schedule calls for 18,500 cars. The improvement in foreign business is even more marked than the domestic, export shipments during January and February totaling 3,407 cars, or more than were shipped abroad in all of 1934 when exports totaled 2,918 cars.

All time production and sales records were broken by Oldsmobile in February. Last month's output of 15,235 cars compared with the previous record of 13,979 cars in April, 1929. A new production record for a single day was set on March 5 when 862 cars were turned out. A four-fold gain in retail sales compared with a year ago brought February volume to 10,968 cars, exceeding the previous February record by 500 cars. Plans call for production of 17,000 or more cars in March. Despite the heavy production so far this year, there has been little or no accumulation of stocks by dealers.

Retail deliveries of Ford cars and trucks in February in the U. S. totaled 90,857 units, the largest volume for any month since April, 1934, and with that exception since August 1930. The February total was 138 per cent greater than the February 1934 domestic retail deliveries of 38,177 units. World production of Ford V-8 cars and trucks in February totaled 135,663 of which 126,646 represented U. S. production including export shipments, and 9,017 units Canadian production.

Setting new records for February, the Chrysler Corp. produced and shipped 80,277 passenger and commercial cars last month, comparing with 54,516 in February 1934. This brings total shipments of Chrysler-made cars to date this year to 163,153 units, increase of 97.3 per cent over the company's previous record for the two months. All Chrysler factories are operating on record production schedules. The largest number of retail deliveries in any week since that ending Aug. 4, 1934, was reported by Chrysler dealers for the week ending Feb. 23. In this week Chrysler dealers delivered at retail a total of 2,790 Plymouth cars and 714 Chryslers, a grand total of 3,504 units. This is the first time that the 3,000 mark has been passed in 29 weeks.

Shipments of 1935 Hudson and Terraplane cars up to March 2 totaled 26,183, a gain of 87.9 per cent over the 1934 shipments up to the corresponding date. During February 2,000 more cars were sold at retail than a year ago.

Graham-Paige orders for February called for 6,368 cars which brought the year's total to 8,069 as of Feb. 28. The company reported unfilled orders at 2,883 after shipping 3,485 cars during February. Production for the month was 3,717 cars. It is reported Graham is scheduling a March production of 4,500 cars.

Shackno Act, Wis. Law Knocked Out by Courts

New York's Shackno Act, NRA enabling law, and Wisconsin's Recovery Act were ruled invalid this week by high courts of the respective states. The Appellate Division of the New York Supreme Court and the Supreme Court of Wisconsin handed down the decisions. In both instances the presiding justices ruled that the respective legislatures lacked the constitutional power to abdicate or delegate their legislative authority.

Fred Crawford Thompson

Fred Crawford Thompson, 51 years old, vice-president and general manager of the Morse Chain Company, a subsidiary of Borg-Warner, died at his Detroit home March 6, following an illness of several weeks. He had been identified with the automotive industry for 32 years, joining Morse Chain in 1914 as Detroit manager and during the last five years was vice-president and general manager. He is survived by his wife, Zula H., a son, John E., and a daughter, Jean.

Smith Equipment Corp. to Build Shop Material

The Herb Smith Equipment Corp. has been organized to design, build and market modern shop equipment. At the head of the new corporation is Herb Smith, who for many years was sales manager of the Manley Manufacturing Co. of York, Pa., and more recently associated with Kellog of Rochester, N. Y. The Smith corporation's headquarters is Rochester. The company plans to announce a line of hydraulic garage jacks at an early date.

Automotive Fan & Bearing Co.

The Automotive Fan & Bearing Co. reports a net loss of $8,998 for the fiscal year ending June 30, 1934. The company's current position as of June 30, 1934, is shown in the following table:

	June 30, '34	Dec. 31, '33
Current assets ..	$75,693	$62,898
Current liabilities	84,621	55,521
Working capital.	(d) 8,928	7,377

Perfect Circle Co.

The Perfect Circle Co. reports a consolidated net income for 1934 of $549,762 comparing with $397,039 for the previous year. On Dec. 31 the company's current position was shown as:

	1934	1933
Current Assets (Inc. $616,571 cash) ..	$2,529,097	$2,297,738
Current Liabilities....	324,456	244,482
Working Capital	2,204,641	2,053,256

Mack Trucks, Inc.

Mack Trucks, Inc., earned a net profit of $17,134 for 1934 against a net loss of $947,909 for 1933. Dividend payments during 1934 totaled $632,673. The company's current position on Dec. 31 was:

	1934	1933
Current assets (Inc. $3,016,110 cash)	$23,377,997	$26,694,968
Current liabilities..	1,783,658	1,904,871
Working capital ..	21,594,339	24,790,097

Universal Products Corp.

A net profit of $187,912 for 1934 is reported by the Universal Products Corp. which compares with a $57,595 net profit in 1933.

CALENDAR OF COMING EVENTS

SHOWS

Mankato, Minn., Automobile Show — Mar. 16-23

Machine Tool Exposition—Cleveland — Sept. 10-21

CONVENTIONS AND MEETINGS

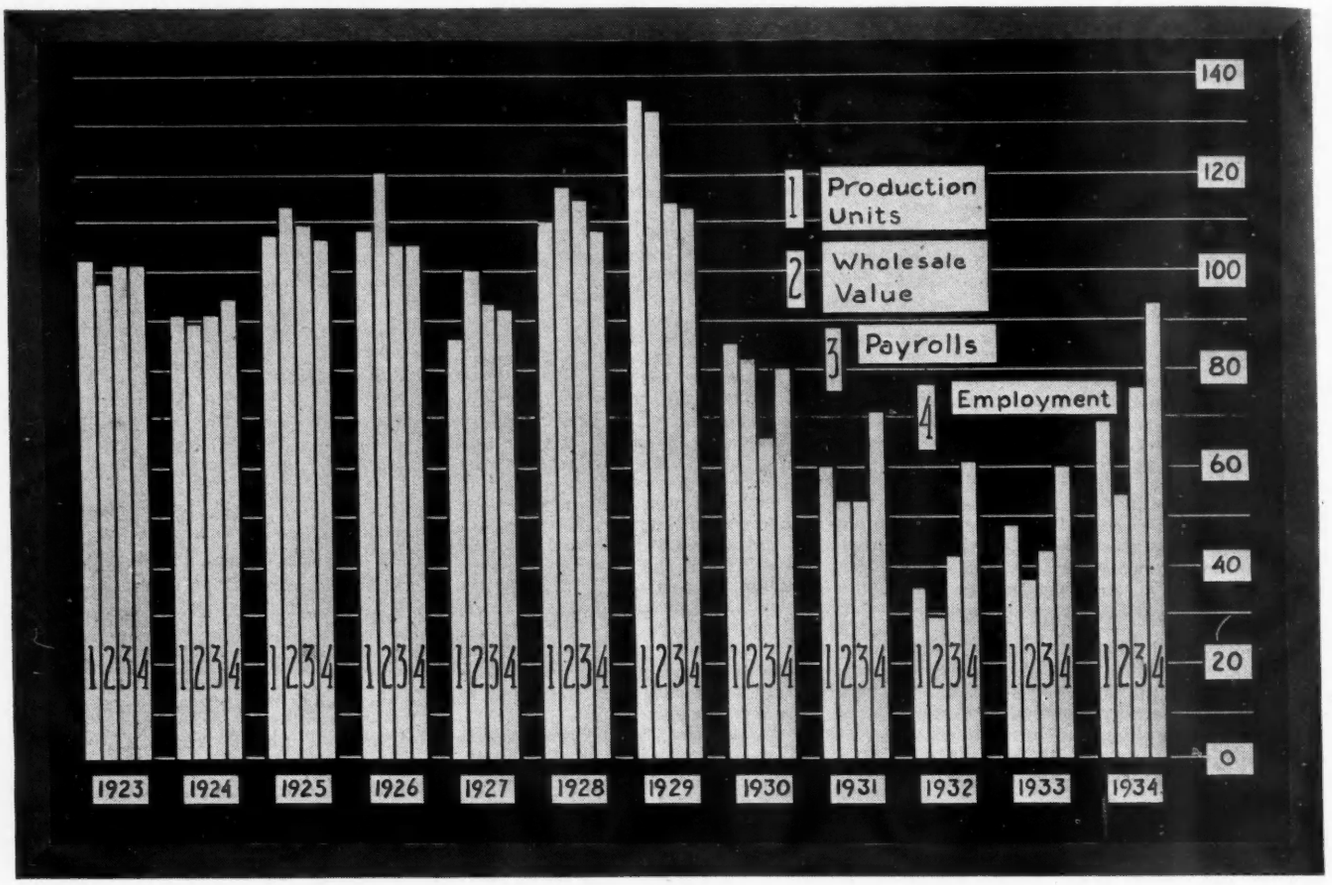
U. S. Chamber of Commerce Annual Meeting, Washington, D. C. — Apr. 29-May 2

Lafayette, Ind. (Purdue University), Automotive Service Conference, — Mar. 21-22

National Battery Manufacturers Assoc. Spring Convention, Cleveland, May 22-23

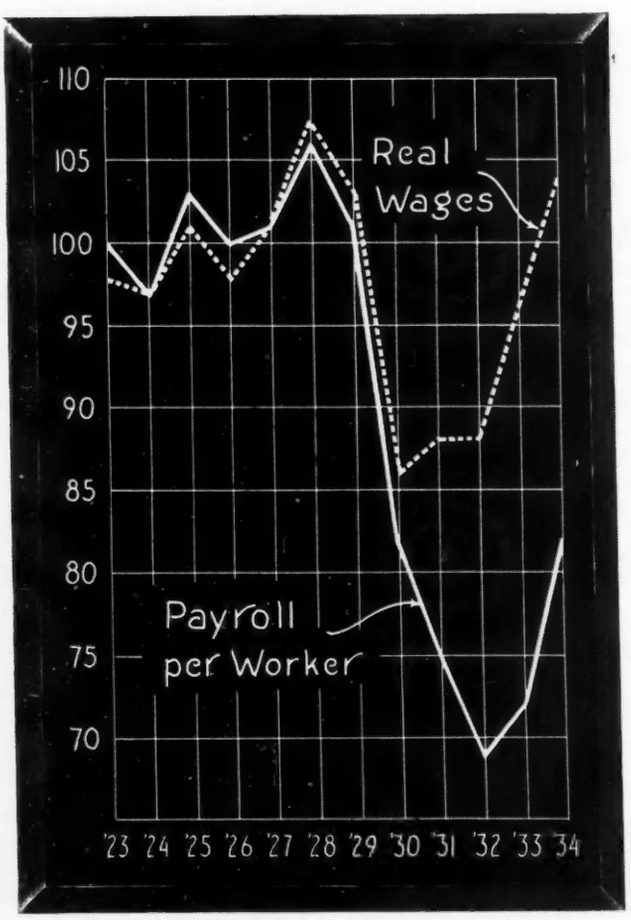
S.A.E. Summer Meeting—White Sulphur Springs, Va. ..... June 16-20

American Society for Testing Metals, Detroit ..... June 24-28



Twelve-year comparison of motor vehicle production, its wholesale value, and automotive payrolls and employment. 1923-1925 average—100.

Sources: Production index, Federal Reserve Board. Wholesale value, computed from AMA data. Payroll and Employment, Bureau of Labor Statistics.



1934 Automotive P
Buying Power as ir

ALTHOUGH 1934 production, both in units and wholesale value, lagged far behind 1930 official government indexes indicate that the automotive industry employed more people and through its payrolls distributed more purchasing power than in any year since 1929.

Unit production last year was 69 per cent of the 1923-1925 average against 85 in 1930 and 135 in 1929. The wholesale value of last year's output was 54 per cent of the average for the

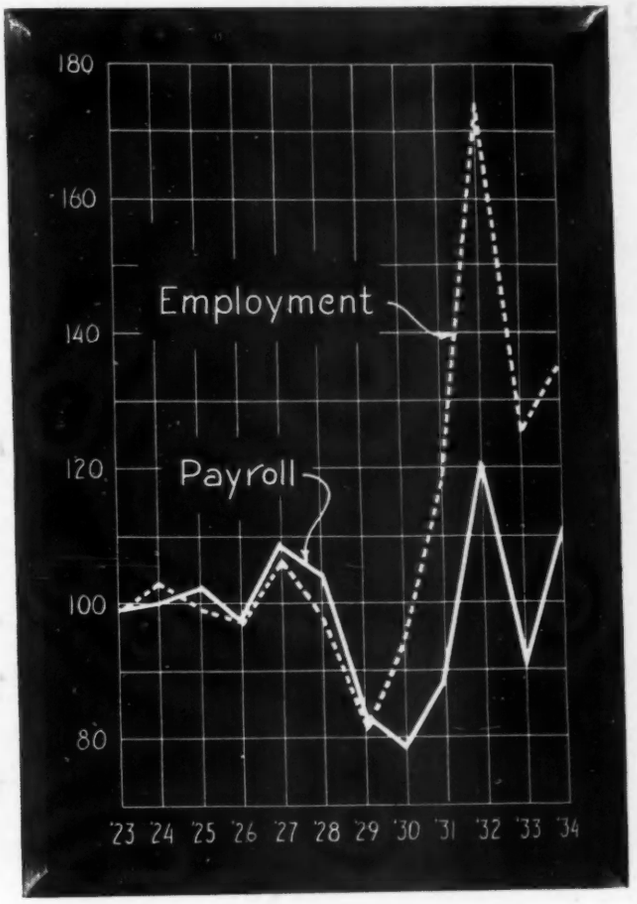
Buying Power at √ 1929 Level

The payroll per worker index, indicative of average annual earnings, is derived from the BLS payroll and employment indexes. The National Industrial Conference Board cost of living index, was then used to get the real wage curve.

same base years, as compared with 82 in 1930 and 133 in 1929. But the payroll index stood at 76 as contrasted with 66 in 1930 on a larger output and with 112 in 1929. Similarly the employment index for 1934 is 93 against 80 in 1930 and 111 in 1929, and exceeding the 1927 employment index of 92.

The derived index of payroll per worker, i. e. average earnings, was 82 in 1934, which compared with 72 in 1933, 82 in 1930 and 101 in 1929. When these indexes are adjusted for changes in the cost of living, it is found that in purchasing power average earnings last year were slightly in excess of 1929—104 against 103. This result, incidentally, was achieved in the face of a substantial reduction in the number of hours worked per week due to the requirements of the code.

The index of the industry's payroll per unit produced, also a derived figure, reached 110 in 1934 as compared with 90 in the previous year. Only in 1932, when low production raised hob with efficiency, did this index of cost go higher. In 1929 it was only 83 despite the fact that the price of the average car then was materially higher than it was last year. Employment per car produced in 1934 also was only exceeded by the 1932 index. It reached 135 last year as compared with 94 in 1929.



Per Vehicle Produced

These curves were derived from the BLS payroll and employment indexes and the FRB production index.

by Don Blanchard
Editor, Automotive Industries

Pay Envelopes Average as Much in 1929, U. S. Indexes Indicate

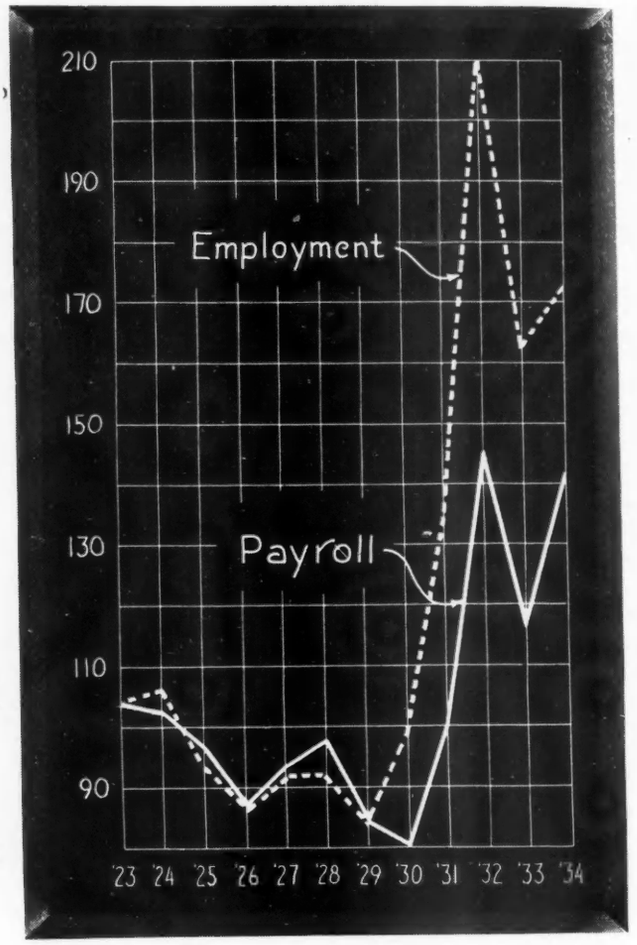
Automotive Production, Payrolls and Employment

	Payrolls	Employment	Payroll per Worker	Real Wages	Production (Units)	Wholesale Value	Per car produced: Payroll	Per car produced: Employment	Per $ of Wholesale Value: Payroll	Per $ of Wholesale Value: Employment
1923.....	101	101	100	98	102	97	99	99	104	104
1924.....	91	94	97	97	91	89	100	103	102	106
1925.....	109	106	103	101	107	113	102	99	96	94
1926.....	105	105	100	98	108	120	97	97	87	87
1927.....	93	92	101	101	86	100	108	107	93	92
1928.....	114	108	106	107	110	117	104	98	97	92
1929.....	112	111	101	103	135	133	83	82	84	84
1930.....	66	80	82	86	85	82	78	94	80	98
1931.....	53	71	75	88	60	53	88	118	100	134
1932.....	42	61	69	88	35	29	120	174	145	210
1933.....	43	60	72	96	48	37	90	125	116	162
1934.....	76	93	82	104	69	54	110	135	141	172

1923-1925 = 100

Perhaps the best measure of the effects of increased wage rates and shorter hours on the industry's costs is provided by the indexes of payroll and employment per dollar of wholesale value of the industry's production. The index of payroll per dollar of wholesale value reached 141 in 1934, against 116 in 1933, 145 in 1932 and 84 in 1929. Employment per dollar of wholesale value stood at 172 as compared with 162 in 1933, 210 in 1932 and 84 in 1929.

These figures are of particular interest in view of the criticisms that have been directed at the industry recently, especially since they reveal what official records show the industry is doing to cooperate with the Government in its efforts to increase mass and individual purchasing power, and to spread employment. Moreover the evidence that these figures provide on the cost of such cooperation is significant.



Per Dollar of Wholesale Value

These curves were derived from the BLS payroll and employment indexes and the index of wholesale value.

Value of Products (at F.O.B. Factory prices) of Motor Vehicle—Bodies and Parts Used in Original Equipment and for Replacements

(Census of Manufacturers—1933)

	1933	1931
Bodies—Passenger	$167,852,681	$225,678,202
" Public Conveyance	1,468,734	5,077,088
" Truck, Commercial, etc.	11,670,090	15,795,272
" Truck Cabs	3,971,882	†
" Trailers	5,433,089	†
Parts—Radiator (Sheels and Cores)	16,443,269	25,726,111
" Windshields	4,229,807	2,977,147
" Axles (Front)	10,985,633	15,723,268
" Axles (Rear—complete assemblies)	33,548,172	52,021,625
" Rear Axle Shafts	3,632,866	2,357,274
" Wheels	14,410,290	23,973,026
" Rims	2,472,377	5,761,868
" Frames	15,693,976	21,764,953
" Gears — Steering (complete units)	5,217,870	6,735,003
" Gears — (Transmission, Differential, etc.)	26,273,819	44,792,850
" Shock Absorbers	6,895,454	10,559,650
" Bumpers	4,043,665	6,703,860
" Other than those reported above*	392,293,634	436,880,840
Springs—Leaf	8,752,130	11,983,932
Engines—Aircraft	8,651,247	13,779,791
" Marine, inboard	948,965	5,524,395
" Marine, outboard	1,249,064	2,351,992
" Automobile (incl. taxis, light truck and light bus)	2,272,695	16,073,997
" Heavy truck and bus	935,923	2,718,307
" Tractor	807,561	.....
" Railway Car	129,740	832,257
Engines—Industrial	4,029,922	12,288,982
" Other types of carburetor engines	2,459,303	2,851,889
" Carburetor engines not reported, in detail	1,675,939	.....
Electrical—Automobile Lamps	12,268,445	7,944,008
Tires and Tubes	317,631,703‡	352,924,114
Batteries—Motor Vehicle—9 to 21 plates	49,079,609‡	54,532,898
Electrical—Automotive Generators	9,525,710‡	10,584,122
" Automotive Starter Motors	11,739,282‡	13,043,646
" Ignition apparatus (spark plugs, coils, magnetos, etc.)	25,025,385‡	27,805,983
Motor—Vehicle bodies, parts, etc., contract and repair work, and products not normally belonging to the industry, not reported separately	25,551,571	.....
	$1,209,271,502	$1,437,768,350
Parts and Accessories made by establishments engaged in manufacture of complete vehicles	168,858,146	181,444,591
	$1,378,129,648	$1,619,212,941

*—Includes in addition to parts not reported separately, tops, sixwheel sets, bumperettes, rear-axle housings, clutches, heaters, horns, windshield wipers.
†—Included in "Parts—Other than those shown above".
‡—Estimated.

The Design of the Small Ends of Aircraft Engine Connecting Rods

by Glenn D. Angle

WHILE the design problems encountered with the small ends of aircraft-engine connecting rods are by no means as serious as many others which must be dealt with in the course of designing a new engine, we must agree, at least, that they are of sufficient importance not to be treated in a "rule of thumb" fashion. But no matter how important this phase of design may seem by comparison, the following comments are amply justified by the mere fact that they should assist a designer in dealing with problems of this sort, during both preliminary and final analyses.

There are really only two important factors to take into consideration while determining the dimensions or proportions of this portion of a connecting rod; namely, the bearing area for the piston pin, and the strength and rigidity of the boss which supports the bushing. Neither is confined within the close limits so often dictated by the loads and stresses in other design details, because in this particular case the dimensions are influenced in a large degree by the manufacturing requirements. Nevertheless, the bearing loads and the strength of the boss should be checked in every instance as a matter of safety, and we will now deal with the methods which may be satisfactorily employed in an analysis of this kind.

If we assume for the moment that the outer and inner diameters of the hollow piston pin have been computed on the basis of safe working stresses in the material, the problem first resolves itself into a matter of ascertaining if the outer diameter permits sufficient projected bearing area of suitable proportions to be secured. This can be readily checked from the average proportions of many successful designs which the author secured from tables which he had previously prepared with this special object in view.

However, before examining these proportions, attention must be directed to the fact that they actually vary among the three general forms of construction, and it therefore appears advisable first to identify these constructions with a view toward making the references to follow more intelligible.

The small-end construction most widely used in aircraft engines is the one in which the piston pin floats in the bearings provided for it in both piston and connecting rod. It is commonly understood that this construction is featured by the fact that there is less liability of any serious consequences in the event one bearing should seize, and furthermore, the pin can rotate and thus distribute evenly over its surface any wear which may occur. In the second construction, the piston pin is permanently locked in one or both piston bosses, and the bearing is placed in the boss at the small end of the connecting rod. In the third case, the piston pin is clamped or locked permanently in the small-end boss and oscillates in the bosses on the piston.

In the first construction, with full-floating piston pins, it has been found that the pin diameters range from 18 to 33 per cent of the piston diameter, with a majority using a ratio of exactly 25 per cent, which is rather close to the average figure of 23.5 per cent for the 60 or more designs investigated. The ratios of length to diameter among these small-end bearings ran between 1.25 and 2.25, with an average of 1.65, which appears to be a fairly reliable empirical figure, since it closely agrees with the ones found in many of the more successful engines. In small-end designs of this class, it was found that the ratio of the projected area of the bearing in the rod to the area of the piston head ranges from 7.5 to 20 per cent, the average of all designs considered being approximately 11.5 per cent. Further examination also disclosed that it is rather unlikely that the bearing area ever need be more than 15 per cent of the area of the piston.

Among a smaller group of the second class, in which the piston pin is locked in the piston, the diameter of the pin was found to range from 15 to 26 per cent of the piston diameter, and the average was approximately 22 per cent, which is substantially the same as our first example, as would be expected. In checking the ratio of length to diameter, figures ranging from 2.15 to 3.3 were obtained, with an average of approximately 2.5. Now, while the pin diameter may have the same relative proportions as the full-floating type, it is at once apparent that designers have recognized the need for providing longer bearings of greater area in the rod boss, since the rubbing action on the piston pin is not so well distributed over its surface. This is again clearly shown by the ratio of projected bearing area to piston area, which ranges in constructions of this class from 9.6 to 18 per cent, with an approximate average of 14 per cent. Thus we find nearly 20 per cent greater average bearing area provided in the small end of the rod for piston pins that are locked in the piston as compared to those which are permitted to float in both members.

In the third case, where the piston pin is locked or clamped in the small end of the connecting rod, we are concerned only with the diameter and length of the boss. In the designs examined, the diameter of the pin ranged from 20 to 29 per cent of the piston diameter, the average being 25.5 per cent. This figure is obviously higher than the corresponding one for the preceding examples, and may be explained by the fact that added diameter is needed to provide space for the usual clamp-bolt employed, or to retain the necessary strength in the piston pin in view of the notches which are generally cut on the side of the pin to accommodate the clamp-bolt. The ratio of length to diameter ranged from 1.5 to 2.4, with an average figure of 1.75, which is actually not much greater than a similar ratio for the piston pins of the full-floating type.

The figures which have just been presented should prove useful during

the preliminary stages of designing small-end bearings, particularly in securing the most desirable proportions. Although it is rather unlikely that a bearing area so determined could ever prove to be insufficient for the imposed loads, it is usually advisable to compute the maximum or mean unit loads as a precautionary measure. It is genally known that the unit bearing pressures are computed by means of the following simple equation:

$$p = \frac{F}{A}$$

where p = unit bearing pressure (lb. per sq. in.),
F = force (lb.),
and A = projected bearing area (sq. in.).

Few designers ever pay any attention to the mean unit loads, since it is quite evident that the pv values cannot be very high, due to the low average peripheral velocities developed with the oscillating motion of the piston pin. The force employed in computing the maximum unit pressure may be taken from a diagram of calculated resultant forces along the cylinder axis, in which the inertia forces of the reciprocating portion of the connecting rod have been neglected. More often, however, the force is one determined from an assumed maximum unit load resulting only from gas pressure upon the piston, and in the average engine this can be taken as 450 lb. per sq. in. In engines developing b.m.e.p.s. in excess of 120 lb. per sq. in., higher unit loads should possibly be assumed. In any event, we know it is more exact to refer to an indicator card for these values whenever a fairly accurate one is avilable.

In many full-floating designs examined by the author—with 450 lb. per sq. in. assumed to be the maximum unit gas pressure upon the piston—it was found that unit bearing loads from 3500 to 4500 lb. per sq. in. were being sustained with perfect safety. It would be quite rare to find small-end bearings that maintain these loads under normal operating conditions showing any signs of excessive wear during the usual periods of engine operation between complete overhaul. The maximum recommended load may be temporarily placed at 5000 lb. per sq. in. and there need be no great concern about loads up to 6000 lb. per sq. in. in a well-lubricated and properly fitted bearing of the best known materials.

With piston pins locked in the piston, we have substantial reasons for regarding 4000 lb. per sq. in. as the maximum unit bearing load that should be maintained in the average design. Attention has already been directed to the reasons for lower pressures in constructions of this type, and the above recommendations apparently agree with the ideas and experience of several designers. This is indicated by the average figures for such designs, which were found to be approximately 20 per cent greater than the average among the full-floating type.

Despite the fairly elastic rules governing the recommended limits for unit loads capable of being maintained with safety in small-end bearings, they warrant attention, and no designer can excuse himself for ignoring them and getting himself into difficulties. The reader will appreciate the fact that the better designs and constructions are capable of maintaining higher unit loads. This naturally takes into account the materials used, the accuracy or quality of manufacturing, together with the stiffness of the small-end boss supporting the bearing, which will be subsequently treated.

It is not easy accurately to determine the stress occurring in the small-end boss, because the curvature of the ring tends to change under load applications, thereby indicating the existence of bending moments in addition to the strains of tension. But in all probability the piston pin does not permit the deflection to assume such proportions that an appreciable stress is set up by bending; therefore, for all practical purposes, we may regard the stress as one of pure tension. The magnitude of this stress may be computed by means of the simple equation which follows, it being assumed that the boss is virtually a double strap.

$$S_t = \frac{F_i}{A}$$

where S_t = tensile stress (lb. per sq. in.),
F_i = force (lb.),
and A = area of section (sq. in.).

The force to be substituted in the above equation is the maximum inertia force created by the piston assembly, which occurs at any given engine speed the moment the piston reaches top-center position. The stresses computed in this manner should be comparatively low—not much over 3000 lb. per sq. in. among steel constructions. Obviously, the high tensile strength of the materials commonly employed in aircraft-engine connecting rods provides an unusually large factor of safety, and it is at once apparent that we are not primarily concerned with the computed stress by itself, but only in so far as it may serve as a reliable index for the rigidity of this member.

If one wishes to study deflections independently, he may do so by means of the equation given below. First let it be explained that the reasons for maintaining such low tensile stresses in the material is to avoid, if possible, any deflection in the small-end boss which will cause it to pinch the bearing. To investigate this condition, we must take into account the fact that, in a uniform ring under a concentrated load on its inner surface, the decrease in diameter perpendicular to the direction of the load is

$$\Delta = \frac{2 F_i r_m^3}{E I}\left(\frac{1}{\pi} - \frac{1}{4}\right)$$

where F_i = inertia force (lb.),
r_m = mean radius of ring (in.),
E = modulus of elasticity,
and I = moment of inertia of ring cross-section.

From this equation we can derive the following expression for the deflection per inch of diameter,

$$\delta_m = \frac{F_i D_m^2}{E I k}$$

where δ = deflection per inch of diameter,
k = constant determined from experience
and D_m = mean diameter of ring.

For the benefit of the reader who may wish to study the deflection in connecting-rod small-end bosses by this method, it should be explained that the values computed during investigations of several satisfactory designs have seldom exceeded $0.5/k$. It would, therefore, seem fairly reasonable to consider this value closely approaching the safe limit for all practical considerations of this sort.

In an effort to determine purely empirical ratios between the cross-sectional area of the small-end ring and the area of the piston, the author prepared some tables in which a number of successful designs were represented. It will be understood, of course, that the area of the small-end cross-section is calculated or measured in a plane through the piston-pin axis at right angles to the axis of the connecting rod.

It was found that the area of the pin-boss cross-section was between 2 and 3 per cent of the piston area among steel connecting rods which specified machine finish all over. In designs in which cost was evidently a factor of greater importance than weight, and machining operations on

this portion of the rod were eliminated as far as practical, the area of the cross-section ranged between 3 and 4 per cent of the piston area. Among connecting rods made from heat-treated duralumin forgings, it was found that similar ratios were from 6 to 6.5 per cent.

The above values may prove useful in making rough estimates during the preliminary stages of preparing a new design, and it should be clearly understood that they are recommended solely for this purpose. We know very well that comparisons drawn in this manner do not fully take into account the effects of piston inertia forces, and the designer should resort to a more dependable method for ascertaining stresses and deflections before the design is completed.

Effect of Cold on Physical Properties

An investigation of the effects of low temperatures on the properties of materials of construction is in progress at the National Bureau of Standards, plain carbon steels being the phase now under study. The tensile, hardness and impact properties of a given carbon steel in the heat-treated, normalized and cold-drawn conditions are being compared throughout the temperature range from room temperature (68 deg. F.) to minus 112 deg. F. Particular attention is being directed to (1) the effects of inherent austenitic grain size on the low-temperature properties, and (2) the effect on properties at room temperature of the minimum temperature to which the steel has been cooled previously and the length of time it has been maintained at this minimum temperature.

Streamlining Decreases Lift, Drag and Lateral Force

At the National Bureau of Standards, the lift, longitudinal force, cross-wind force, and yawing moment for three automobile models having substantially different body shapes were determined by means of wind-tunnel measurements. The measurements were made for various angles of relative wind between 0 and 180 deg. Estimates based on the model measurements indicate that when an automobile of conventional body shape, geometrically similar to the model used in the tests, is driven at the speed of 50 m.p.h. in a 30 m.p.h. quartering wind the forces and moments of the following order of magnitudes may occur: Lift, decreasing the traction, 400 lb.; longitudinal force opposing the motion of the car, 230 lb.; lateral force pushing the car sidewise, 350 lb.; yawing moment tending to turn the car off the road, 550 lb-ft. For a moderately streamlined automobile the forces and moments, under the same conditions of wind speed and car speed, are estimated to be: Lift, 340 lb.; longitudinal force, 90 lb.; lateral force, 170 lb.; and yawing moment, 770 lb-ft.

Some experiments on the use of fins to reduce the yawing moment were included in the tests, more complete results of which will be found in the December number of the *Journal of Research*.

Nadella Needle Cartridge

A NEEDLE cartridge designed to facilitate the insertion of the needles in needle bearings is being offered by the Société Anonyme des Roulements a Aiguilles "Nadella" of Paris. The cartridge has been on the French market for a year, we are informed, and has been adopted by some of the largest French automobile manufacturers.

With this device the needles are held in such a way that they can all be inserted in the bearing simultaneously, without the possibility of any of them dropping out of place before, during, or after the mounting of the bearing. The device eliminates the need for the use of grease to hold the needles in place while the bearing is being either mounted or dismounted. The needle cartridge is, therefore, particularly adapted to the mounting of needle bearings on a large-scale production basis.

The cartridges are delivered in complete metal-clad units. They consist of the following parts:

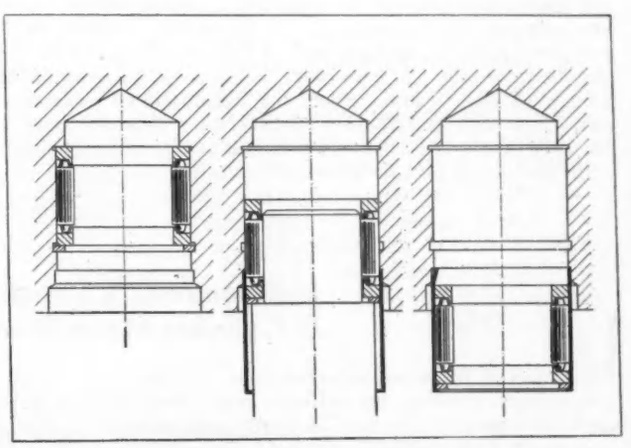
1—A layer of needles, each comprising a tapered lug at each end;

2—Two end-thrust collars of cyanide-hardened steel, each collar being machined to form an annular groove, which engages the tapered lugs on the ends of the needles, thus retaining the latter in position;

3—An expanding retaining ring, which, as soon as the unit reaches its final position in the housing, expands into a groove provided for that purpose in the housing bore, thus locking the needles securely in place in the housing.

The entire unit, comprising the needles, the end collars and the expanding retaining ring, is enclosed in a metallic cartridge consisting of a tubular shell bent inwards to form a retaining lip on the expanding-ring end, and slightly notched inwards at three points on the opposite end, so as to maintain the unit securely within the shell. When the bearing is inserted in the housing, the three notches are automatically forced outwards, thus giving free passage to the needle block.

The operation of mounting the bearing in its housing is very simple. The cartridge is aligned before the housing bore into which the needles are to be lodged, and the complete unit is forced out of the cartridge and into the housing by means of a drift. As soon as the block reaches its final position, the retaining ring snaps into a groove cut in the housing surface, thus locking the bearing securely in place, so that the shaft may be removed at any time without disturbing the needles. The drawings below illustrate the operation in various stages.

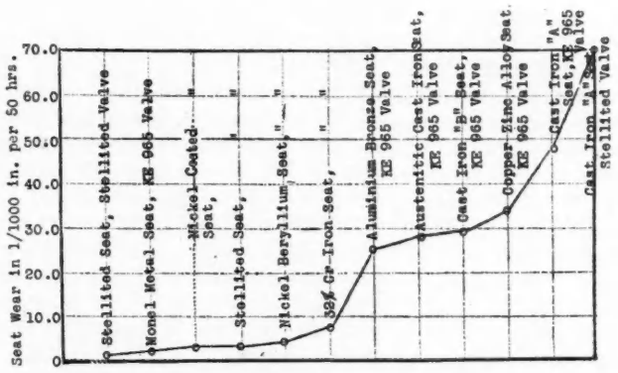


Transferring needles from cartridge to bore

AUTOMOTIVE ABSTRACTS

Valve-Seat Wear

A FURTHER report on the research work on valve-seat wear carried out by the Institution of Automobile Engineers appears in the December issue of the *I.A.E. Journal.* Wear tests were made on valve-seat inserts and valves of different materials, and the results are summarized in the graph reproduced herewith. C. G. Williams, research manager of the Institution, who signs the report, concludes that although it is probably the most important, wear resistance constitutes only one of the many properties which have to be considered in the choice of valve-insert materials. One very important characteristic is the thermal expansion

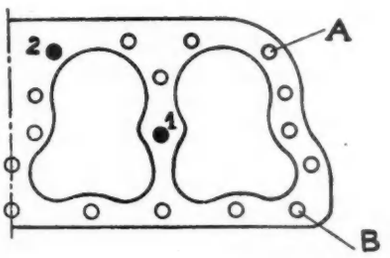


The Graph—"Sinkage" of different valve insert materials.

of the material, and the coefficients of expansion of all of the materials used in the wear tests, and of several others, are now being determined. Machinability is another important property, and several of the materials which were supplied for test purposes were found to be quite unmachinable, even with Widia. From the standpoint of wear resistance, however, satisfactory results were obtained with the Stellited seats, the Tryposited nicked seats, and with inserts of monel metal and nickel-beryllium alloy.

Supplementary Stresses in Cylinder Head Studs

IN a recent issue we referred to a discussion of the supplementary stresses on cylinder-head studs due to explosions in the cylinder, by M. Ziembinski before the French Society of Automobile Engineers. Since that time M. Ziembinski has made some tests to confirm his theory on the subject. It was his theory that cylinder-head studs are subjected to an initial tension due to the nuts on them being drawn up, and to a slight additional tension due to the explosion. It was found that the additional force on the



stud due to the explosion is of the order of 20 per cent of the force of the explosion which might be expected to be taken by one stud. In the test engine the total force of explosion on the cylinder head was 11,500 lb., and one-tenth of this, 1150 lb., should come on stud 1 (see diagram). This force of 1150 lb. should produce an elastic elongation of the stud of

$$e = \frac{3 \times 1{,}150}{0.246 = 29{,}000{,}000} = 0.000485 \text{ in.}$$

Direct measurement showed an extension of only 0.0001 in. or practically 20 per cent. The free length of the stud in the cylinder head was 3 in., its cross section, 0.246 sq. in. (0.546 in. diameter), the area of the cylinder head 23.5 sq. in., the total pressure of explosion on the cylinder head 11,500 lb.

The tests were made on an Aster engine having a cylinder head as shown by the accompanying illustration. A rigid bridge was secured to the studs AB extended, this bridge being supported at its opposite ends by studs symmetrical with A and B. Adjacent to studs 1 and 2 two Solex amplifier comparators were fixed on the bridge, which permitted of measuring the elongation of these studs. Cylinder No. 2 was closed at its lower end by a plate, and by means of a pump hydraulic pressures up to 500 lb. per sq. in. could be pumped up in the cylinder. There was no pressure whatever in the other cylinders. The cylinder head is not stiffened in the vicinity of stud 1 while it is greatly stiffened by ribs in the vicinity of stud 2.

In the first test, using a Plastex gasket, the head was considered rigidly fixed to the block as the gasket was very thin. In the second test a metallo-plastic gasket was used. The results were as follows:

Movement of the cylinder head in microns
(one micron = 0.00004 in.)

Pressure in atmospheres	Stud 1	Stud 2
	With Plastex Gasket	
0	0	0
12	—	0.5
24	—	1.5
35	0.4	2.5
	With Metallo-Plastic Gasket	
0	0	0
35	0.9	2.4

Journal de la Société des Ingenieurs de l'Automobile

JUST AMONG OURSELVES

More Chiselers With Lower Used Car Prices

USED car prices in the official guide book apparently are not so high that there are not plenty of dealers who will go higher to make a sale. Yet the dealer code authority, in response to the insistent clamor of the trade, is bent on making these prices lower, thereby making an acute compliance problem even more difficult.

It is axiomatic that the difficulties encountered in securing compliance vary inversely with the level of top allowances permitted by the guide book. If these difficulties are so great with present prices that many dealers regard the code as unenforceable, they obviously are going to be still greater with lower prices. In the face of this obvious fact, it is hard to understand what dealers hope to gain by an amendment to their code which is intended to reduce guide book prices. One doesn't have to be a Solomon to see that the certain effect of NRA approval of this amendment will be to intensify an already critical compliance problem.

However, we doubt that NRA will approve it, at least in its present form. Aside from the fact that it is intended to reduce guide book prices, it places vast discretionary powers in setting guide book prices in the National Automobile Dealers Association. Whether it is in the public interest to vest these powers in the NADA need not be argued here, but we are inclined to believe that if NADA gets them it will find itself the target for so many dead cats that it will wish that so much had not been left to its discretion.

* * *

Diversification and Codification

WHAT is an industry or trade? Those who have wrestled with this problem recognized from the outset that it was likely to be one of the most difficult questions NRA would be called upon to answer. Last week's hearings on the proposed amendment to the APEM code modifying the definition of the automotive parts and equipment industry confirms this expectation.

Argument raged at the hearing as to whether manufacturers supplying the automotive market should be classified on the basis of the use that was made of their products, as the APEM proposed, or on other bases such as whether their products were castings, forgings, electrical equipment, etc. What decision NRA renders on the debate is of obvious importance because it will determine what codes individual manufacturers are to come under and hence by what wage, hour and fair trade practice provisions they are to be ruled.

Unfortunately for the codification process, the activities of individual manufacturers are too diverse to permit compartmenting industries like eggs in a crate. Our own experience with problems of this kind leads us to believe that the APEM proposal to classify on the basis of use is on the right track. With intelligent administration it seems likely to answer the problem as well as it can be answered.

* * *

Eligibility for Time Payment Paper

ALTHOUGH some have contended that the Federal Reserve Board has power under the present law to authorize the rediscount of finance company paper, there has always been some doubt about the matter. This uncertainty will be swept away if administration-supported amendments to the Federal Reserve Law are enacted. These leave the matter of eligibility up to the discretion of the board, and consequently if the law is revised as planned, the board can make finance company paper eligible, if it sees fit, by regulation.

* * *

Fuel Economy and Large Engines

IN an informal discussion of fuel economy the other day the chief engineer of an important car company reminded us about the one phase we are sometimes prone to forget. "Oversize engines," he said, "do not necessarily mean higher fuel consumption. As a matter of fact," he continued, "a bigger engine in many cases can improve the economy of a given car."

The answer of course is a question of carburetor functioning.

In a small engine, large throttle openings quickly take the carburetor off the economizer and into the relatively rich high-speed jet setting, whereas if the engine were larger, smaller throttle openings would produce the same result and the carburetor economizer would still be operative. The difference in economy at speeds of around 50 to 60 m.p.h. or better is said often to be quite startlingly in favor of the larger powerplant.

—The Editors

Factors Controlling E

Part Two

Part Three will appear in an early issue

FIRING from a single point involves certain inherent limitations in combustion control, which necessitates a compromise in the fulfillment of the various requirements for efficient engine combustion. This becomes at once evident if we consider separately the four fundamental requirements and the basic controlling factors at the designers' disposal to meet each of the requirements.

Assuming the mixture characteristics, thermal conditions and ignition timing fixed for a given engine, the only two remaining variables are chamber shape and spark-plug position. As seen from the table in Fig. 12, none of the four requirements can be fulfilled with one set of conditions of general chamber shape and spark-plug location. The main objective, maximum power, requires a short combustion time, which is obtained by means of a compact chamber fired in the center of volume. Volume control for smooth combustion generally results in a non-compact chamber fired on the valve side. Detonation control incorporates the close clearance space and limits the spark-plug to a position which insures that the reaction ends in the clearance space. Idling and high-speed performance requires that the spark-plug should be located in the direct path of the incoming fresh charge.

In L-head engines the compactness of the combustion chamber is limited by a fixed outline determined by valves, piston and a minimum throat area, but, on the other hand, the close clearance space is an inherent feature, which makes the L-head chamber a suitable form for detonation control. The main objection is that the plug has to be set off center of volume in order to make the close clearance space effective, which means a sacrifice in power. But even assuming a chamber having a short combustion time (high maximum rate of pressure rise) and incorporating an effective close clearance space, thus satisfying the requirements for maximum power and detonation control, a low maximum acceleration in pressure rise (for smoothness) could be obtained only if the initial rate of pressure rise could be made very high.

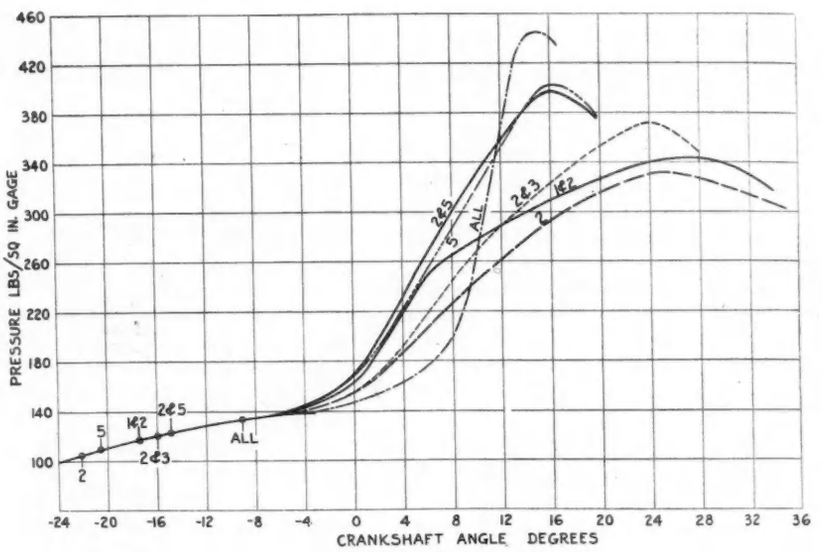


Fig. 13—P-t characteristics of combustion chamber shown in Fig. 3 fired at positions 2, 5, 2-5, 2-3, and 1 to 6 inclusive.

The highest initial rate of combustion possible with a single firing point is obtained if the plug is located in such manner that the flame spread for the first, say, 1½ in. is unhindered by the chamber walls. But even in this optimum case, which cannot always be realized, there is a fixed limit for the initial spread with one plug. Volume-distribution control is also limited to a certain degree by the partly fixed contour of the chamber.

Now, if one wanted to define an ideal case, disregarding the limitations fixed by the foregoing considerations, it would be a chamber having the following characteristics:

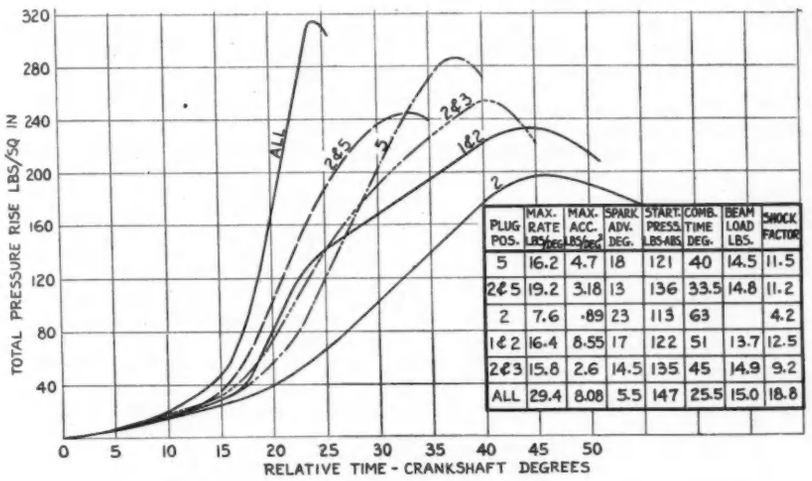
1. High maximum rate of pressure rise (short combustion time).
2. Low maximum acceleration of pressure rise (smooth combustion).

REQUIREMENTS	CONDITIONS	P-T CHARACTERISTICS	CHAMBER SHAPE	PLUG POSITION
1- HIGH THERMAL EFFICIENCY (MAX. POWER)	SHORT COMB. TIME (LOW HEAT LOSS FROM BURNING GASES)	HIGH MAX. RATE OF PRESS. RISE	COMPACT	IN CENTER OF VOLUME
2 SMOOTH COMBUSTION	VOLUME CONTROL	LOW COMBINED VALUE OF MAX. ACC. AND MAX. RATE OF PRESS. RISE	GENERALLY NON COMPACT	NOT IN CENTER OF VOLUME
3 MINIMUM DETONATION	LOW TEMP. OF LAST PORTION OF UNBURNT MIXTURE-(HIGH HEAT LOSS FROM UNBURNT GAS)	HIGH MAX. RATE OF PRESS. RISE (BELOW CRITICAL LIMIT)	CLOSE CLEARANCE SPACE	NOT IN CENTER OF VOLUME
4 GOOD IDLING AND HIGH SPEED PERFORMANCE	INFLAMMABLE MIXTURE AT SPARK PLUG			ON PERIPHERY OF INTAKE VALVE

Fig. 12—The four basic requirements for efficient engine combustion and the factors controlling the requirements are tabulated to show the necessity of a compromise with single ignition.

Engine Combustion

by Hector Rabezzana
and Stephen Kalmar



PLUG POS.	MAX. RATE LBS/SQ IN/DEG	MAX. ACC. LBS/SQ IN/DEG²	SPARK ADV. DEG.	START. PRESS. LBS-ABS	COMB. TIME DEG.	BEAM LOAD LBS.	SHOCK FACTOR
5	16.2	4.7	18	121	40	14.5	11.5
2&5	19.2	3.18	13	136	33.5	14.8	11.2
2	7.6	.89	23	115	63		4.2
1&2	16.4	8.55	17	122	51	13.7	12.5
2&3	15.8	2.6	14.5	135	45	14.9	9.2
ALL	29.4	8.08	5.5	147	25.5	15.0	18.8

Fig. 14—Pressure rise on relative time basis from p-t curves in Fig. 13 and tabulated values of corresponding maximum rates, maximum accelerations in rise, and combustion time.

3. Close clearance space (detonation control).

4. Ignition point located in path of fresh gases in such a manner as to insure the end of the reaction in the close clearance space (idling and high-speed performance, detonation control).

This ideal case can be realized by using two spark-plugs instead of one.

Combustion Control by Multiple Ignition

By using two plugs, fired simultaneously, instead of one, the range of combustion control is very much increased. By varying the distance between the plugs and their relative locations in the chamber, almost any pattern of p-t characteristic can be obtained. At the same time, combustion time becomes, to a large degree, independent of combustion chamber contour and can be decreased at will, and both the initial rate and the maximum rate of pressure rise may be varied to suit any requirement. Some idea as to what extent combustion can be controlled by double ignition can be had from Figs. 13 and 14, which represent p-t characteristics obtained in a 3½ x 4 in. single cylinder test engine of the L-head type, equipped for multiple ignition, which enabled us to study various combinations of spark-plug positions and to compare single and double ignition. (For detailed results see Single-Cylinder Tests.) Fig. 13 represents the pressure-time characteristics of a combustion chamber shown in Fig. 3 fired at various positions (2, 5, 2-5, 2-3, 1-2, all), the ignition timing for each case being minimum advance for maximum power.

The pressures in these curves are taken from actual indicator cards. Fig. 14 shows the pressure-rise curves on a relative time basis. From these curves the maximum rates and maximum accelerations and the combustion times were evaluated. They are tabulated in Fig. 14 together with the corresponding brake-load values. The run with *all plugs* firing was included to present an extreme case.

Comparing the values for Positions 5 and 2-5, we see that the shock factor is the same for both cases, which means equal smoothness. The maximum rate of pressure rise for Position 2-5 is higher than for 5, which means higher heat transfer from the unburnt gases, and, consequently, less detonation. The combustion time for Position 2-5 is shorter, which results in lower heat loss from the burning gases and consequently more power, as reflected also in the beam load readings. These results, however, do not represent optimum solutions. The plug locations in the combustion chamber used in these tests were selected before the results

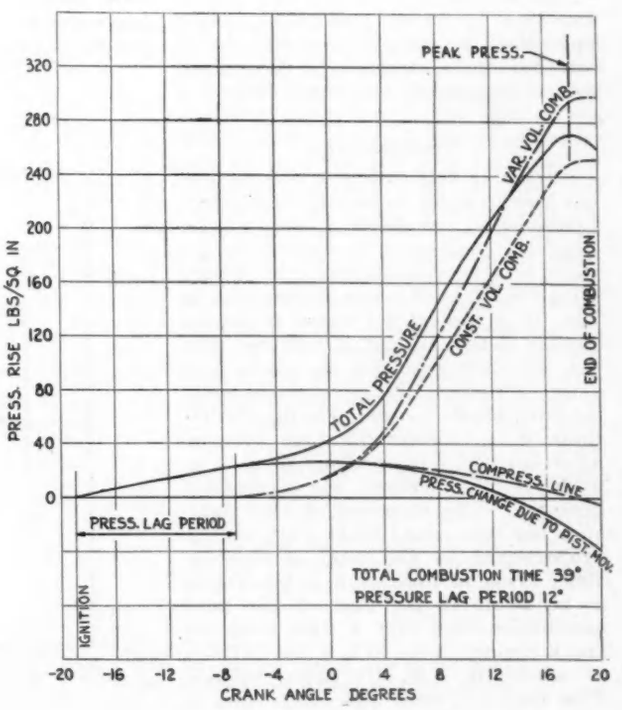


Fig. 15—Typical p-t curve replotted from indicator card and combustion curve evaluated therefrom, showing pressure lag and actual end of reaction.

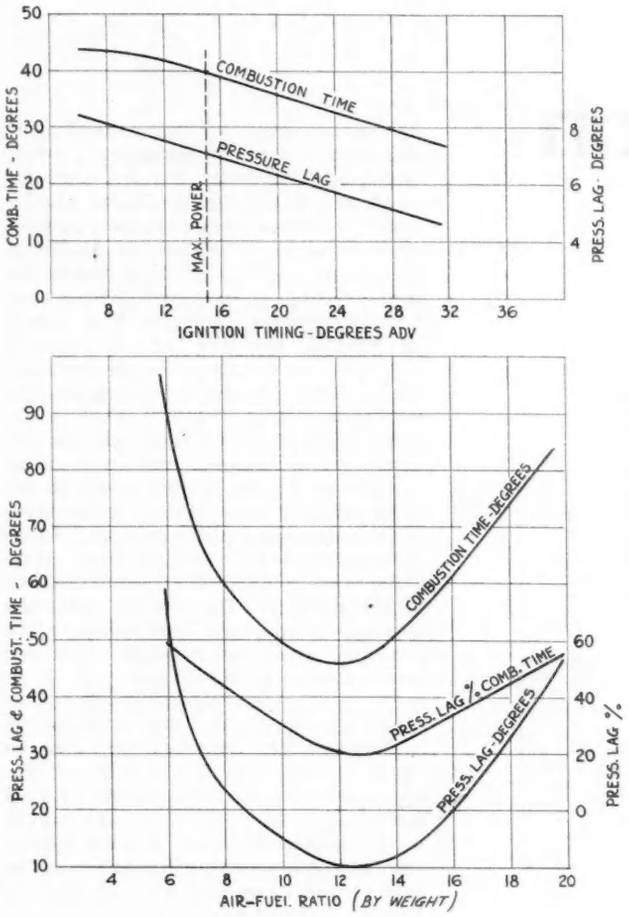


Fig. 16 — Variation of pressure-lag period with ignition timing and with air fuel ratio. The upper chart shows how the pressure lag varies with spark advance (firing from position 5). The lower chart represents the variation of the pressure lag with air-fuel ratio.

of the present study were analyzed, and there is no doubt that there are better positions for two ignition points in this particular chamber than the ones tested.

The method of selecting the proper locations is purely analytical, based upon the inherent p-t characteristics of chamber types, which are determined by indicator cards and flame diagrams.

Pressure Lag

Earlier in this article it was pointed out that in order to be able to compare fundamental combustion characteristics, it is necessary to reduce the p-t curve to a combustion curve by eliminating the effect of piston movement. In Fig. 15 a typical p-t curve is shown, similar to that in Fig. 2, together with the pressure rise due to combustion alone. Two facts of interest can be noted in this combustion curve. The first is that there is a considerable time interval after ignition, during which there is no evidence of increase in combustion pressure. The duration of this pressure lag was found to be very closely proportional to the total combustion time; firing at Position 5, it was found to be about 18 per cent of the total combustion time over a wide range of spark timing (from 30 to 5 deg. B.T.C.) as shown in Fig. 16, upper curves. This series of runs was made with a normal mixture supplied by the carburetor.

The lower curves show what happens if the air-fuel ratio is varied. The lag in percentage of the total combustion time increases on each side of the maximum-power ratio from approximately 10 per cent to about 60 per cent for an extremely rich or lean setting. Increasing the engine speed from 600 to 2000 r.p.m. decreases the lag (in percentage of total time) from 16 per cent to 6 per cent. Changing the electrical characteristics of the spark (by varying gap width from 0.007 to 0.051 in., or the distributed capacity in the secondary from 10 to 100 MMF) had no effect upon the pressure lag. From all these results it seems that the pressure lag is primarily due to a constant pressure condition, found also by other investigators, which obtains at the beginning of combustion and lasts until the walls begin to affect considerably the movement of the gases. This means that the greater the mean length of flame travel the longer the absolute duration of the pressure lag. But inasmuch as the total combustion time also increases proportionally to the mean length of flame travel, the pressure lag in percentage of combustion time remains nearly constant for the same reaction velocity. If the reaction velocity is changed, however, the pressure lag will change accordingly.

The End of Combustion

A second point of interest is that the combustion process proper is usually not yet completed when the peak of the pressure-time line (representing the total pressure) is reached (See Fig. 15). This is due to the fact that in the total pressure-time curve, the peak occurs when the rise due to combustion just equals the pressure decrease due to expansion due to piston movement. (It is assumed, of course, that the peak occurs after TDC, as is generally the case.) In reality, the combustion pressure is still increasing, but the expansion due to piston movement causes a decrease in pressure which is more than the rise due to combustion; consequently, the total pressure decreases. That the combustion still persists, after the peak is reached in the total pressure line can be best seen in the flame-

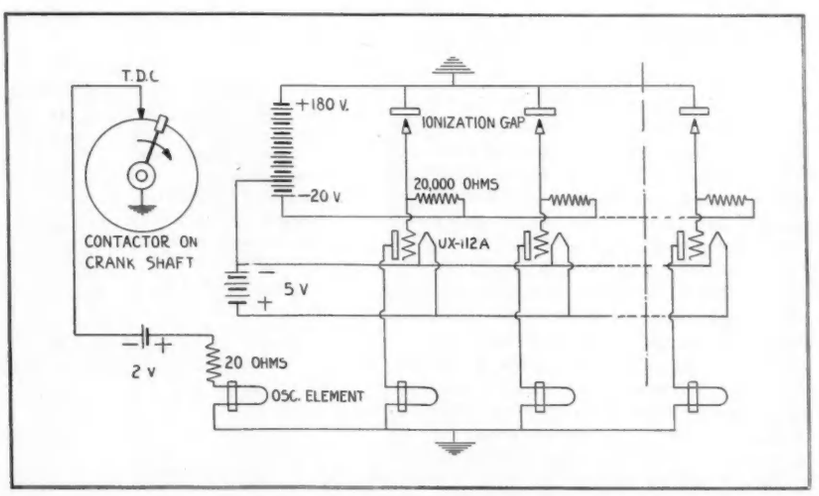


Fig. 17—Diagrammatic view of the ionized gap connections for taking flame diagrams. (Method of Dr. K. Schnauffer.)

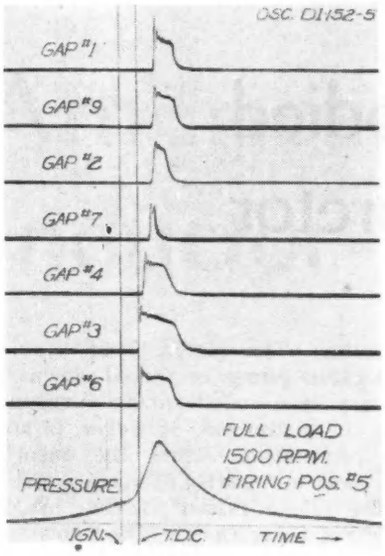


Fig. 18—Flame travel oscillogram, showing p-t diagram and the arrival of the flame at the ionized gaps 1 to 9, inclusive.

travel diagrams. The fact is important when comparing combustion times under different conditions.

Flame Diagrams

Besides indicator cards, another method was used in the present study to compare the effect of firing positions upon combustion characteristics. Simultaneously with indicator cards flame diagrams were taken, employing Dr. Kurt Schnauffer's method of ionized gaps. The set-up is shown diagrammatically in Fig. 17 and one of the records in Fig. 18. From the latter, the times from ignition to the arrival of the flame-front at the measuring gaps were calculated, and then a flame travel diagram was developed showing the progress of the flame-front in the combustion chamber during equal intervals of time. A series of flame travel diagrams corresponding to the p-t curves in Fig. 13 are shown in Fig. 19. These diagrams show very distinctly, first, how the linear speed of the flame changes during combustion and, second, that its speed is not uniform in all directions, but changes according to heating or cooling effects (e.g. valves). Note the difference in speed after corresponding time intervals when firing at the exhaust and firing at the intake valve respectively; although the combustion chamber is symmetrical, a tilting of the flame-front by the heating effect of the exhaust valve is evident. From the flame diagrams the volume of the burned charge was calculated and plotted in Fig. 20.

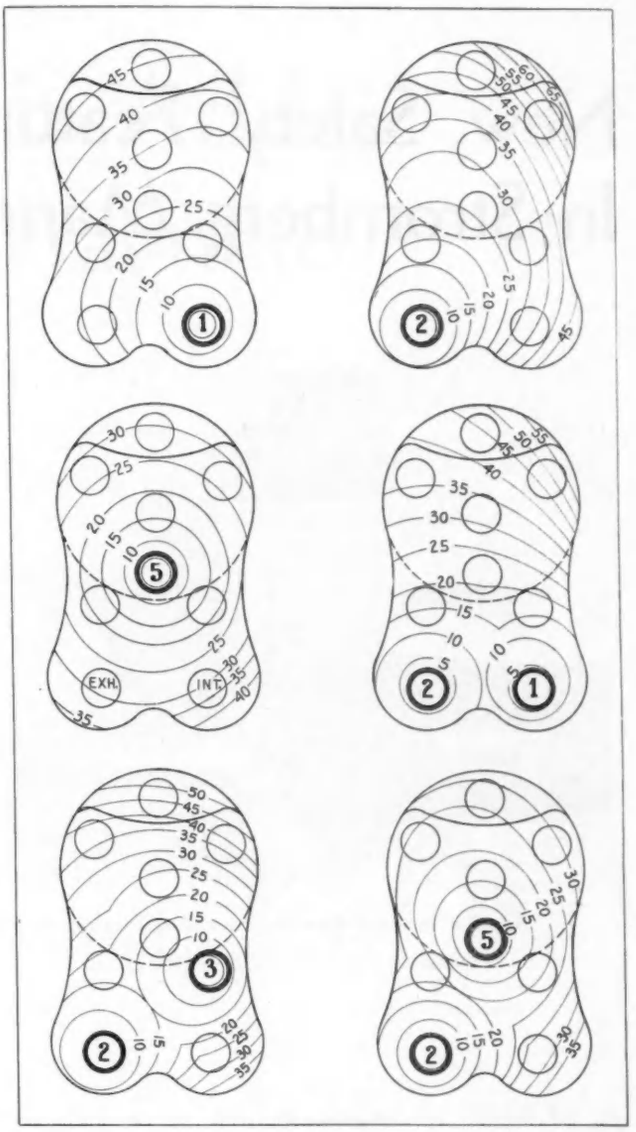


Fig. 19—Flame travel diagrams corresponding to the p-t curves shown in Fig. 13.

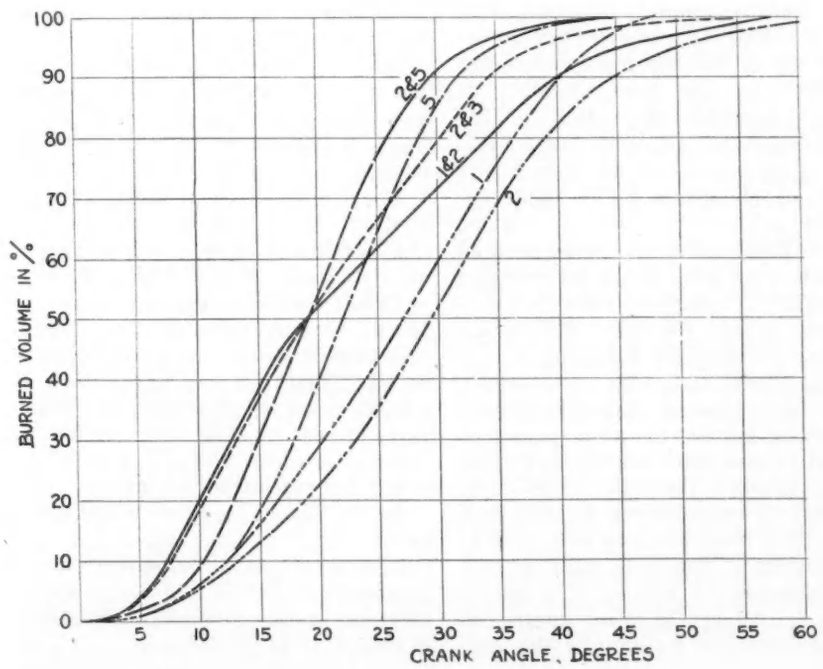
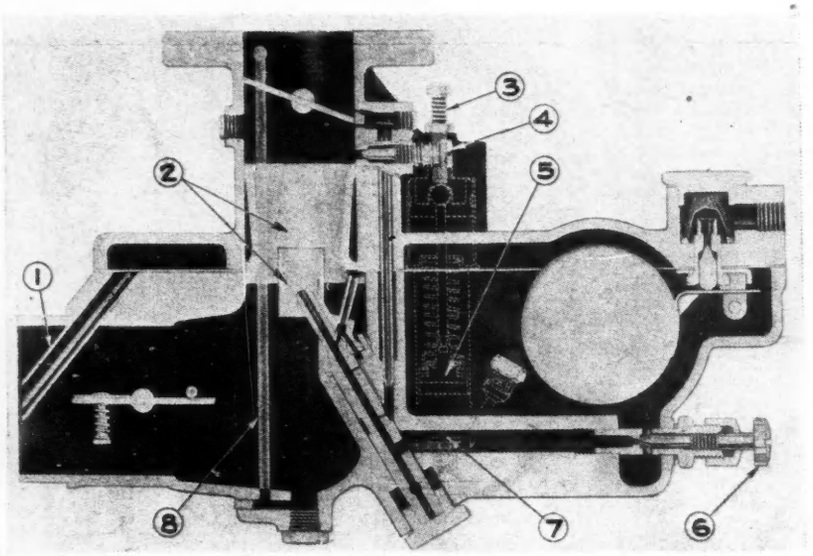


Fig. 20—Burned volume-time curves, computed from the flame diagrams shown in Fig. 19.

New Safety Features Embodied In Stromberg Marine Carburetor



Section through Bendix-Stromberg marine carburetor.

A NUMBER of safety features are embodied in the new marine carburetor of the Stromberg Carburetor Division of Bendix Products Corp., South Bend, Ind. One of these is provision for automatic draining. When the engine is being started from cold, liquid gasoline accumulates at the bottom of the carburetor below the venturi. As may be seen from the sectional view of the carburetor reproduced herewith, a drain tube extends from the sump in which the gasoline collects, up to a point above the throttle valve. When the throttle is partly closed, as when idling during the warming-up period, there is a relatively high vacuum above the throttle valve, and this sucks any liquid gasoline from the sump, thus draining the latter. In addition to disposing of the condensed fuel, this arrangement has the advantage that it provides a somewhat rich mixture during the warming-up period, which is particularly desirable in cold weather.

The float mechanism is of the hinged type and is designed to operate under pressures ranging from 6 in. gravity head to 2 lb. per sq. in. pump pressure. To prevent fuel from slushing out in rough weather, the float chamber is completely sealed. The necessary vent is located inside the air horn, hence the pressure in the float chamber is always balanced with that of the air horn, which prevents the formation of an extra rich mixture in the event of clogging of the flame arrester.

The fuel passages are so located that the fuel level in the jet remains substantially constant under all conditions, which prevents stalling of the engine in rough weather.

Like other Stromberg carburetors, the marine type is of double-venturi design, which has the advantage that the air speed past the outlet of the fuel nozzle is quite high, which tends to improve atomization of the fuel. The main fuel-metering orifice is at the bottom of the float chamber and is controlled by means of a needle valve 6. An accelerating pump and economizer are built into the carburetor. The piston 5 of the accelerator pump is forced down by means of a coiled spring surrounding the piston rod. However, in normal operation, when the throttle valve is only partly open, this piston is held in a raised position by the vacuum above the throttle valve acting on the piston at the upper end of the accelerator pump. If the throttle is suddenly opened all the way, the vacuum above it drops; this decrease in vacuum communicated to the space above the accelerator pump, and the spring then pushes the piston of the accelerator pump down, thereby forcing an additional charge of gasoline through the spray nozzle.

Another effect of the downward motion of the accelerator-pump piston is that the economizer needle valve at the bottom of the pump is opened. As long as the vacuum above the throttle valve (or in the inlet manifold) remains low, the accelerator-pump piston remains in its lowest position and the economizer nozzle remains open. Under these conditions fuel is supplied to the spray nozzle by both the main metering jet and the economizer jet, the main jet furnishing about 85 per cent and the economizer about 15 per cent of the total. Thus a maximum-power mixture is obtained when the throttle is opened wide, and a maximum-economy mixture with the throttle in the cruising position.

Control of fuel delivery in proportion to the air flowing through the carburetor is effected by means of air bleeds in the fuel nozzle.

These carburetors are made in brass, bronze, or cast iron. Brass and bronze carburetors are finished by sand blasting and application of a coat of transparent lacquer, which gives them a nice satin finish of brass or bronze color. The standard finish for carburetors with cast iron body is black lacquer with brass parts.

A separate sales organization for marine carburetors has been created recently in the Stromberg Division, in charge of H. A. Hansen.

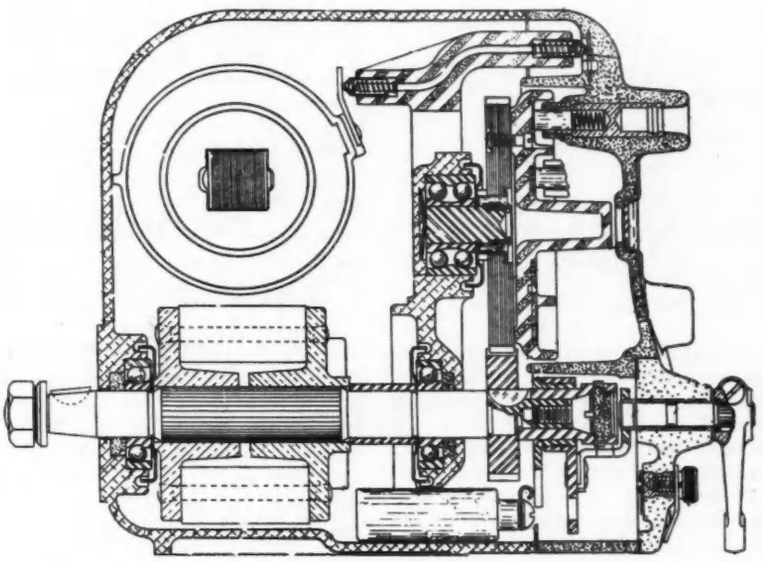
American Bosch Adds Inductor-Type Magneto

UNITED AMERICAN BOSCH CORPORATION, Springfield, Mass., recently added to its line of ignition products an inductor-type magneto known as the MJA4A. It has a stationary coil or winding and magnets which rotate between laminated pole pieces. The condenser and the interrupter arm also are stationary.

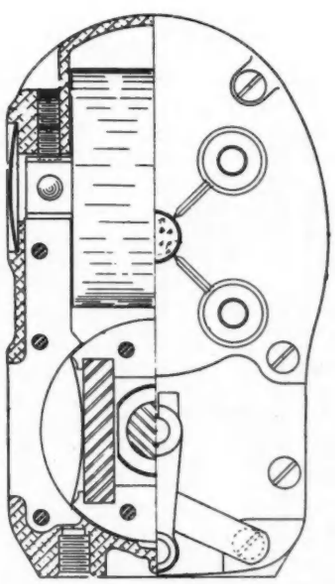
The housing of the magneto is an aluminum die casting which has the laminated pole pieces cast in. Two ventilators, consisting of double wire screens with a layer of silk between, are provided in the housing near the rear flange of the rotor.

The magnet rotor has bronze flanges at both ends, the flange at the rear (distributor end) being provided with impeller blades to increase the air circulation. The rotor shaft carries two strong permanent magnets which when the rotor is in the magneto are in line with the laminated pole pieces cast in the frame.

Magneto-type ball bearings, packed in grease, support the rotor at both ends. The ball bearings have formed grease-retaining washers, and as an additional safeguard against the escape of grease, impregnated felt sealing washers are located adjacent to the bearings. The distributor pinion is keyed to the rear portion of the rotor shaft and the same key locates the interrupter cam, both the pinion and cam being held in position by a single screw, a lock washer and a taper-edged washer which seats in the conical bore of the cam. The cam surface is lubricated by means of grease-saturated felt wicks held in the cam by a snap ring. One wick has two projections which extend through the walls of the cam into the path of the interrupter-lever striking block.



Longitudinal section through Bosch inductor-type magneto



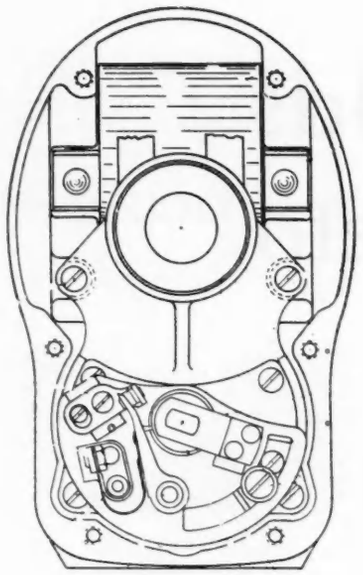
End elevation and half section at axis of coil

The coil comprises a laminated core on which the winding is mounted, the whole being enclosed in a molded housing of insulating material. The inner end of the low-tension winding is grounded to the core, while the outer end is secured to a clip fastened to the insulated cover. The end of the secondary winding is brought out at the center of the coil housing, where it terminates in a formed brass electrode with which the connector to the distributor plate makes contact. A safety gap is formed between the upper edge of the coil electrode and the magneto housing.

The coil assembly is mounted on the pole pieces by means of two headless set screws, one of which serves as a lock. Both screws are accessible from outside the magneto housing at the top.

A distributor-gear bracket in the form of an aluminum die casting, which is secured to the magneto housing by means of four screws and lock washers, contains the rear rotor bearing, and the distributor-gear bearing, and supports the high-tension connector. The condenser, which is of round form, is located below the distributor-gear bracket.

Tungsten contact points are used in the interrupter, which is said to be designed for high-speed operation and long life. The stationary contact point is mounted on a formed steel plate, which is adjustable by means of an eccentric screw and held by means of a holding screw and a lock washer. An insulated steel bracket supports the interrupter spring, which also carries the primary current, this spring being held in place by a hexagon-head screw and lock washer. The insulated bracket is riveted, one of its rivets also holding the condenser clip and low-tension-terminal clip, the other being extended into a metal stud with spring and metal brush which serves as the



End elevation with cover removed, showing details of interrupter

short-circuiting (or grounding) device of the magneto.

The complete interrupter assembly is located on the center hub of the brass supporting plate and permanently fastened to the distributor-gear bracket by three screws. An adjustable stop limits the angular movement of the interrupter in relation to the cam for advancing or retarding the spark. On this particular magneto the stop plate provides for 30 deg. retard.

An angle bracket riveted to the interrupter plate extends over the center of the hub. A suitable slot is provided which, when in engagement with the key stud operated by the lever, effects manual control of the interrupter assembly.

The distributor gear assembly comprises a steel shaft carrying a gear of phenolic material and an insulated rotor, the latter being fastened to the gear by three screws. An extension of the rotor has an arrow engraved upon it, which is visible through a window in the distributor plate. Consequently, it is not necessary to remove the distributor plate when timing the magneto to the engine. The distributor-gear assembly is supported in a double-row ball bearing. A ball-and-spring locking device in the steel shaft prevents the assembly from falling out.

The high-tension conductor is molded in rubber insulating material. Metal brushes with coil springs behind them are placed in sockets in both ends of the conductor, one brush contacting with the high-tension terminal of the coil, the other with a conducting strip in the distributor plate. The connector is secured to the top of the distributor-gear bracket.

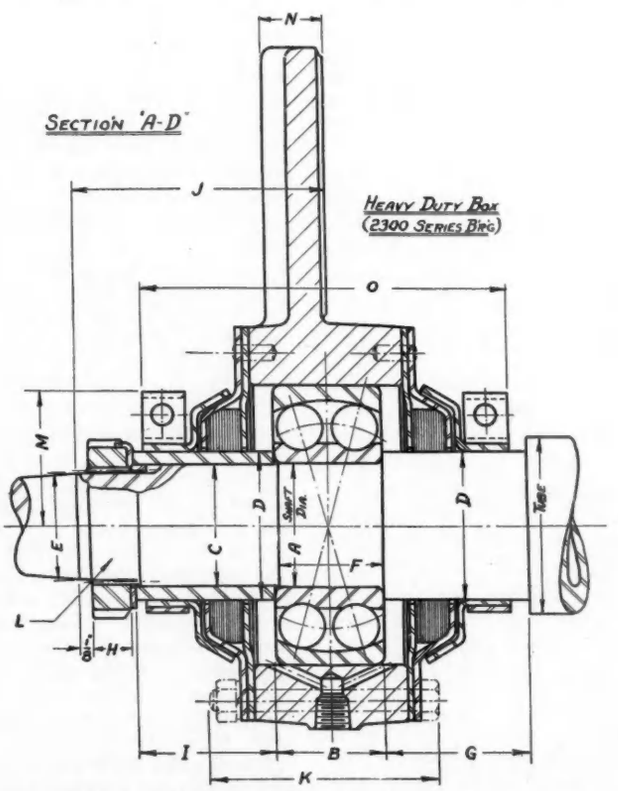
The distributor plate is made of phenolic material and has brass inserts for the high-tension brushes and terminal connections molded in. A glass window held in place by a snap ring is located on the axis of the distributor-rotor extension, and through it a segment-indicating arrow can be observed. Indicating marks extend from each high-tension tower to the edge of the window, to facilitate this observation. The high-tension outlets contain sockets for push-type terminals. The distributor plate closes the rear opening of the frame and is fastened to the frame with six screws with lock washers. These screws are so made that they remain anchored to the plate when the latter is removed, to prevent their loss.

The end cap provides for automatic short-circuiting of the magneto when the interrupter plate is moved into the retard position. It is made of fiber-packed-phenol insulating composition and carries a bronze bearing for the timing arm shaft, in addition to the brass connections and track for the short-circuiting brush. A brass thumb screw with lock washer fastens the grounding spring to the short-circuiting terminal. This grounding spring seats on the lower distributor-plate screw head. The timing-arm lever, of forged brass, is fastened to the steel shaft by means of a binding screw which clamps the split hub of the arm against the knurled end of the shaft. The timing arm may be fastened in any desired angular position. The steel snap ring on the outer end of the shaft and the shoulder on the inside maintain the assembly of the shaft and the end cap. Two screws hold the end cap to the distributor plate.

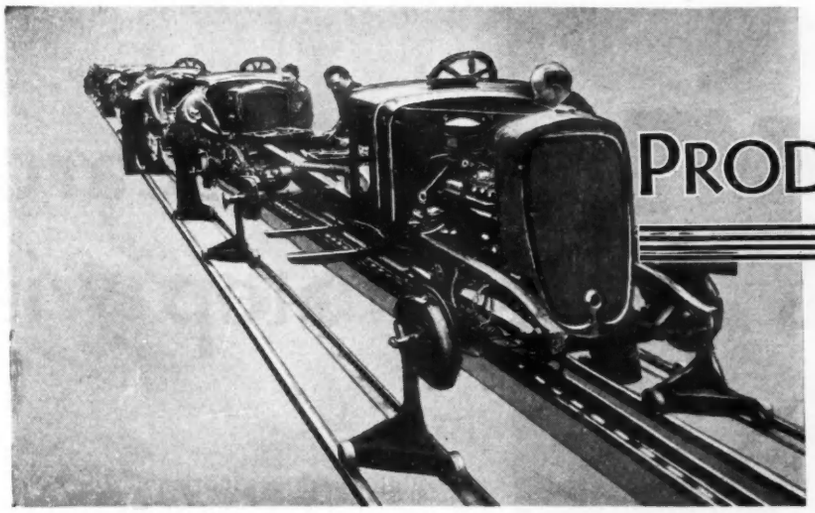
Where practical, the parts are cadmium-plated for rust protection. Gaskets of velumoid are placed between end cap and distributor plate, between distributor plate and frame, and beneath the observation window.

S. K. F. Automotive Propeller-Shaft Box

S. K. F. Industries, Inc., Philadelphia, Pa., has developed a standard automotive propeller-shaft box for use on the propeller shafts of commercial vehicles. S. K. F. self-aligning ball bearings are used in this box, and are said to compensate for chassis weave and distortion. Dirt is kept out and lubricant in by felt seals and flingers at both ends of the housing. This shaft box assembly, which fits S. A. E. standard stub ends, includes the housing, end covers, felt washers, flingers, clamps, sleeve and lock nut. It is made in two series, for propeller shaft tubes of from 2 to 3 in. outside diameter, the heavy-duty series and the medium-duty series, the first of which is illustrated herewith.



Longitudinal section through S. K. F. heavy-duty propeller-shaft box.



PRODUCTION LINES

Designer's Role

It is no longer safe to say, as we did in days of yore, that a designer has created something better and cheaper to produce—unless the design is predicated upon a new conception. Let it be acknowledged that design must include a consideration of three interdependent functions: materials, process and production equipment. You can't be sure of lowest costs unless you have studied the potentialities of new equipment. The selection of materials must include a consideration not only of the desirable properties in the structure but also machinability and facility of handling in production. The new day engineer must consider materials, process and equipment, together, if he will really have the best product.

De-Oxidizer

A newly-developed sodium-zinc alloy is being introduced by the Grasselli Chemical Co. to the nonferrous metallurgical field for expediting the elimination of oxide, gas occlusions and similar casting faults in brasses and other zinc-bearing alloys. This material is very easy to use. One merely adds certain fixed amounts to the metal bath before pouring. The final cast brass contains no sodium and is remarkably free from blow holes, faults, shrinkage holes and spills.

Truck Deck

An aluminum finish decking material has been added by the Fabrikoid Division of the du Pont Company. It is particularly suitable for the topping of trucks used in the transportation of dairy products and other perishables. Its aluminum surface does not absorb the rays of the sun nearly so much as black.

Look at Facts

Much has been said, and continues to be said, by many people concerning the effects of the machine. Hysteria on this score has reached the point where even the experts hesitate to say anything about the remarkable technological advances that are being made today. Yet no one in the public eye has stressed, in recent times, the role of the machine as an emancipator of labor: the relief from fatigue, from back-breaking effort and the like that the machine has brought about. More than this, the machine has made it possible to pay higher wages—higher than ever before in the history of our civilization. Look at all the facts before you single out any of the shortcomings of the technological era.

As Foil

Chromium plating for auto exteriors assumes a new role on the basis of 1935 models. No longer is it simply a good decorative medium to be scrapped at will with the winds of fashion. It is on a sounder footing as used today—as a foil to set off certain features of body styling. Thus the bright areas set off the distinctive hood louvers and grilles, bring out the peculiar charm of an applied belt line, and help to carry out the unified line treatment at the running board and fender skirt junctions. Here is a detail treatment that holds limitless possibilities.

Better Lifts

The thing that bothers most people in their consideration of the new cars is the real difficulty involved in servicing a flat tire or attaching skid chains, or a number of other usually simple operations. They have the answer in Europe, in fact about half a dozen answers, inasmuch as there are at least that many makers of built-in jacking systems. It would seem that this attachment has all the necessary sales appeal to assure its adoption at a profit.

Midgets Coming

Midget racing is spreading the country over, if our informants have the right dope. It is a fact that in New York the midget cars are all the rage. In one indoor arena they use a track only one-fifth of a mile long and are said to soup 'em up to 50 mph. Many of the little cars, if not most of them, are using outboards—two- and four-cylinder with plenty of power. Here is a good outlet for outboard production, and it may rival the demand for water craft if encouraged.

Cutting Oils

To certain men in the metal cutting plants of this industry, cutting fluids are among the most important engineering materials with which they are concerned. In the interest of these men we propose the formation of an independent or voluntary committee of experts to collate the needed practical data without further delay. Many troublesome questions still go unanswered and the right group can get reasonable answers within a short time. Let's hear from you.—J. G.

MANUFACTURING MANAGEMENT METALLURGY

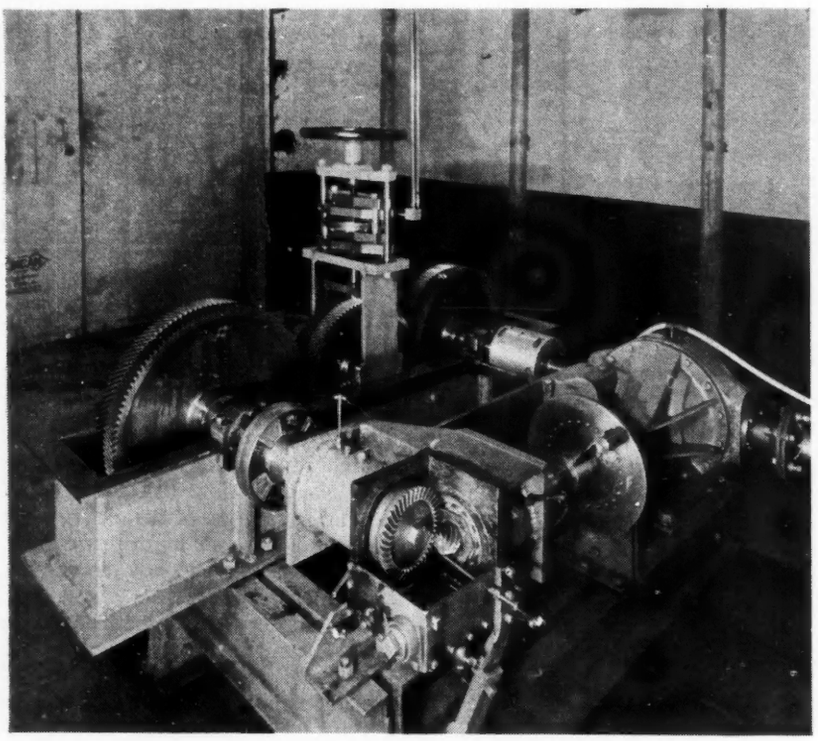


Fig. 1. General view of full-sized hypoid testing machine with cover removed. At the left, center, is the handwheel for load increment control through the large herringbone gear train.

Research K
Step with P

ANOTHER swing of the wheel of progress whirls us into the automotive developments for 1935—higher engine performance, insistence upon lower weight with greater load-carrying ability in a smaller compass, and more hypoid gearing. How will these hurdles affect the program of fuel and lubricants research? What is the petroleum industry doing to anticipate the needs of the automotive engineer?

To shed some light on these questions we sought the cooperation of one of the great laboratories—that of the Socony-Vacuum Oil Company, Inc., whose research establishment is located in Paulsboro, N. J. Here incidentally, is an excellent example of the partnership that exists between the automotive industry and its allied producers, affording a fair conception of the vast amount of energy and money expended in cooperative research aimed first at discovering the fundamental problems of mutual interest and second the development of commercial products that meet these practical needs.

The knowledge born of these scientific crucibles seems to be so absorbing and so close to the every day needs of automotive engineers that we have included here some of the behind-the-scenes activity of the organization.

Among the objectives of the Socony-Vacuum research laboratories are the following few which to us represent true points of contact with the industry:

1. Fundamental research in fuels and lubricants, involving combustion studies, and various lubrication projects including E-P characteristics, lubricity, etc.
2. Development of commercial products meeting practical service conditions.
3. Continual improvement of commercial products.
4. Development of research techniques which may be applied to a degree by the user in the selection of products now on the market.

Through the courtesy of the company, we have been given a frank picture of what this laboratory is doing and thinking about certain matters current in automotive circles today. Let us take E-P lubes as an example. In petroleum circles this is considered a more complex problem than simply the ability of a lubricant to carry extraordinary unit pressures. To meet the exacting standards set by this laboratory, an E-P lube must possess the following qualifications:

1. Maximum load carrying capacity.
2. Maintenance of E-P characteristics for long service periods.
3. Freedom from sludging, gumming, foaming, and separation.
4. Freedom from corrosive effects either on the gear surfaces or those of the component parts of the unit.

Readers of *Automotive Industries*, of course, are familiar with the history of E-P development particularly the project at the Bureau of Standards aimed at the design of a universal test machine which is to give a quick testing method affording at the same time, a practical correlation with actual operating conditions. Until a satisfactory test machine is built, the Socony-Vacuum laboratory is continuing the use of a special four-square hypoid gear machine which will be described presently.

To us, it seemed most impressive that a complete cycle of tests of one "lube" in this machine takes a full week of hard work. This includes the time required to adjust the gear set, and to run two separate tests with two gear sets—a high speed test to destruction and a low speed test to destruction, if possible. In view of the time and expense involved in this procedure it is easy to understand why a certain technique has been devised to eliminate by rapid tests any E-P materials that are unworthy of the final test.

Here then is the gauntlet that must be run by an E-P sample before it is permitted to smash up a set of hypoid gears:

1. Preliminary check on the

Keeps Fuels and Lubricants in Progress in Automotive Design

by Joseph Geschelin
Engineering Editor, Automotive Industries

Almen tester to determine whether any E-P characteristics exist.

2. Exposure to bronze and steel strips at 340 deg. F. for 5 and 24 hours.

3. Aging tests for E-P stability at 340 deg. F. for 48 hours.

4. Determination of shelf separation by a series of tests—in glass, in combination with strip tin, at room temperatures, in the cold room, at high temperatures, and in a combination of the latter two tests.

5. Test in four-square worm gear boxes rated at one horse power each, overloaded to carry about six horse power, for a run of 200 hours. At the conclusion of this period, the gear boxes are torn down and examined for evidence of scoring, sludging, corrosion and tooth wear. Then the lubricant is again run in the Almen tester to see whether any E-P properties are left.

6. If a sample lives through these preliminary tests, it goes on to the formal test to destruction in the four-square hypoid machine.

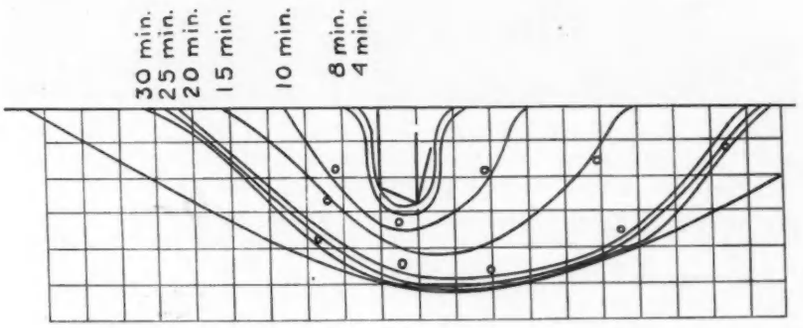


Fig. 3. Chart showing how thermocouples are arranged to show circulation to various bearing points. Small areas indicate percentage circulation during given intervals.

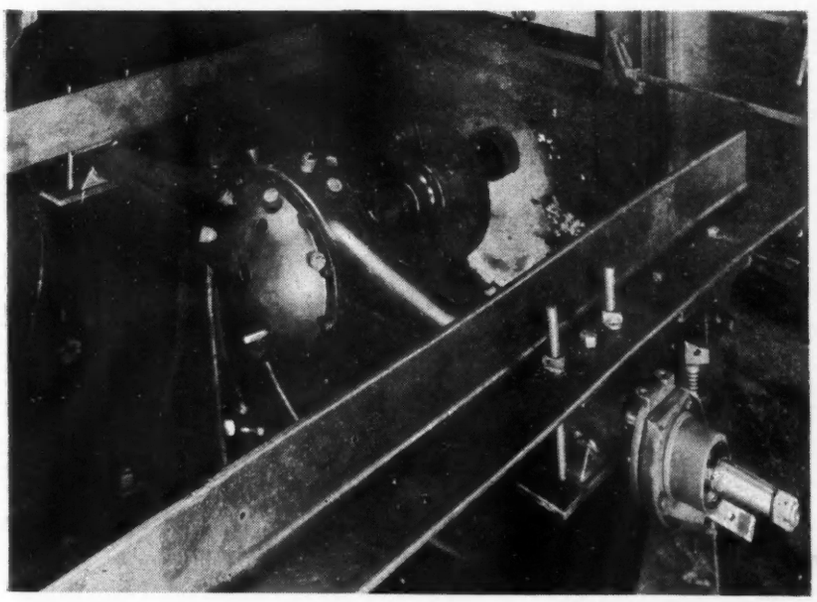


Fig. 2. Set-up of commercial rear axle, in cold room, to study channeling characteristics of gear lubes.

A general view of the hypoid machine with gear housings removed is shown in Fig. 1. Its principle of operation, briefly, is that load increments up to full load—5000 pounds pressure per inch of tooth length—as well as shock loads and reversal of load, all are accomplished by a simple manipulation of a hand wheel control over the center idler gear of the three-gear herringbone train, at the left. The maximum tooth loading at the hypoid gear, as given by the Hertz equation, is approximately 200,000 lb. per sq. in.

In operation, load increments around 1000 lb. per min. are applied while the machine is running. Shock loads and full load are also applied without stopping the machine. Before each increment in load, the cover is removed at the hypoid gear set for examination, particularly to note first signs of scoring.

If an E-P lube is found that will pass the whole test without faltering, it can be accepted as a promising product; until that time comes, the best material is one offering

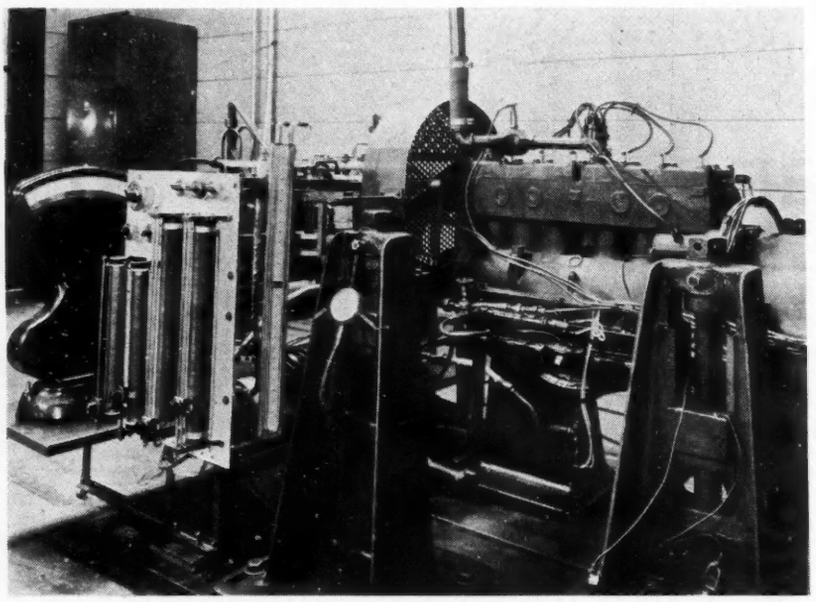


Fig. 4. Perspective of dry-sump lubricating system for studies of oil consumption rates.

the most acceptable compromise of qualities.

Fig. 2 shows a test set-up of more than passing interest designed to study the channeling characteristics of commonly-used gear lubricants. This is a production rear axle mounted in the cold room and driven by an electric dynamometer. As is evident from the illustration, the cover plate is honeycombed with peep holes permitting the observation of flow. Actual circulation or distribution effects, however, are gaged by the behavior of a series of 13 thermocouples set at various critical points in the axle, forming the locus of the pattern traced in Fig. 3.

Circulation at any point during any interval of time is evidenced by a significant rise in temperature. A very interesting device is used to estimate the percentage circulation during any given interval. This consists in noting the location and number of thermocouples exhibiting a rise in temperature and connecting the points by a line as shown in the small areas in Fig. 3. The relation of the small area to the area bounded by the thermocouple locus is a measure of percentage circulation.

This test procedure has yielded much valuable information concerning the behavior of gear lubricants under sub-zero conditions. Perhaps the most significant is the phenomena of change in channel point characteristics for the same material due to "aeration." The phenomena is this: a certain well-known gear lubricant with an A.S.T.M. pour point of 30 deg. F., having 40 per cent distribution below 20 deg. F. is run in the axle starting from cold—minus 20 deg. F.—until the temperature reaches 70 deg. F. Then power is shut off, the axle permitted to cool down to cold room temperature. When the axle is run again circulation is not established until the temperature exceeds 58 deg. F. which means loss of circulation for ten minutes or more. This seems to happen to many grades of lubricant in varying degrees, the increase in channel point temperature varying from 50 degs. down to 10 degs., although with some lubricants there is no change whatever. When the same lubricant, after the test described above, is heated in the axle to 125 or 175 deg. F., chilled down and run again, the channel point is either back to normal or even below the pour point. Obviously, a lubricant which exhibits this characteristic to the least degree is to be preferred.

Oiliness is the subject of another project in this laboratory. As in the case of the E-P research, while

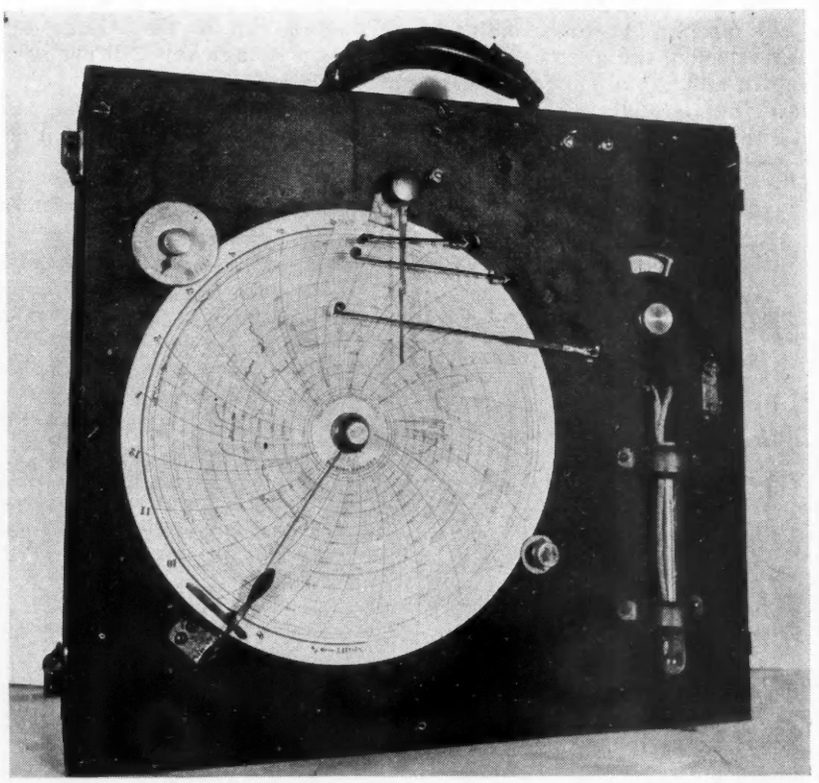


Fig. 5. Face and recording chart of portable instrument for investigating starting characteristics of car in owners hands. Top pen records duration of starter operation, second pen records engine revolutions, bottom pen gives fluctuations in manifold pressure during test.

the commonly available test equipment is being used, little reliance is placed upon the findings until the results can be correlated with the performance in some suitable full size equipment.

It has been found that lubricants giving the lowest coefficient of friction do not necessarily give the least wear. In connection with the lubrication of automobile engines it is felt that rate of wear of engine parts is of equal if not greater importance than a reduction in friction. To that end there are now in the process of construction two single-cylinder test engines which are to be used in studying the performance of different lubricants in relation to wear under different types of service, to wit:

1. Bearings — under all conditions of operation.
2. Cylinders and rings — under high speed operation.
3. Cylinders and rings—at low speed and low temperature to determine the role of corrosion products.

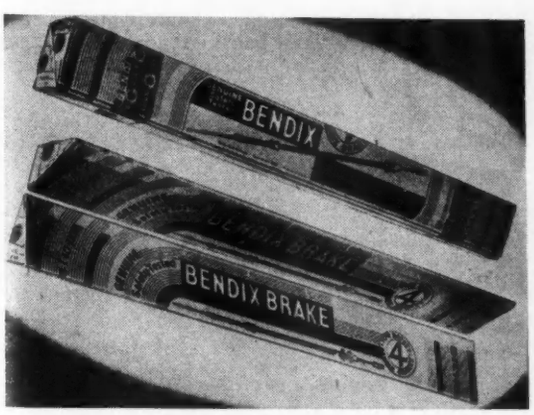
At the International Automotive Engineering Congress in 1933, J. P. Stewart presented a paper entitled, "Factors Affecting Oil Consumption" which described a unique apparatus for the determination of oil consumption data.

A perspective view of the set-up is shown in Fig. 4. Its essential principle is that of a dry sump circulating system with accurate control of oil flow, control of oil temperature and cooling system temperature, as well as control of the other variables incident to engine operation. The outstanding features of the test are—first the ability to complete an oil consumption test within an hour with an accuracy better than four per cent, and second, the ability to compare several oils during the same run without stopping the engine.

This test method holds great promise for future investigation of oil consumption since it is possible to study separately the effect of any given variable, including the effect of piston and ring design and piston ring combinations.

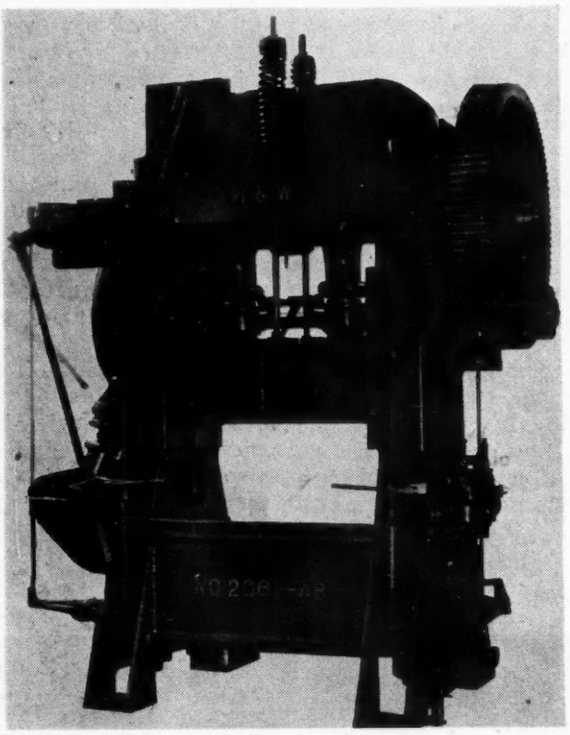
In view of the special problems incident to the lubrication of aircraft engines, the laboratory is conducting a long series of tests on a single-cylinder air-cooled engine employing aviation engine cylinders, and an engine having high temperature liquid cooling. One of the products of the work to date is the conclusion that certain oils cause ring gumming with amazing rapidity once a critical level of operating conditions has been exceeded.

A rather interesting investigation is also being carried out on the starting characteristics of cars in the owners' hands. In order to carry laboratory precision into the field, a portable instrument is being used which gives the significant data to a precision of one-quarter second. Fig. 5 illustrates the face and recording chart of this instrument. When connected, the top pen records the duration of starter operation, the second pen records engine revolutions and the third pen gives the fluctuations in manifold pressure during the test. The operator also takes readings of cooling water and oil sump temperature by means of the sensitive potentiometer device built into the meter. Samples of oil and gasoline also are drawn off to complete the data.



Packages for automotive parts got All-America ranking in the 1934 competition staged by the magazine Modern Packaging. The Chevrolet containers took the first prize gold medal in the fibre can group while a Bendix brake lining package was awarded the third prize bronze medal in the shipping container class

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools



Steel Presses With Automatic Feeds

The Henry & Wright Mfg. Co., Hartford, Conn., has recently added single geared straight sided double crank welded steel presses arranged with automatic double roll feeds and scrap cutter.

The presses are of the shrunk-in tie-rod type of construction with the bed, uprights, crown and slide made of special welding quality steel carefully heat treated after welding but before machining to release strains that may be present in the welded unit.

Specification changes or modifications from standard in these presses to meet customer's particular requirements are claimed to be readily possible because of the absence of pattern requirements. Consequently, changes are made quickly and economically.

Presses may be driven either by a direct connected motor or by flat or V-type belt, according to customer's requirements and in cases where belt drive is desired, the motor may be mounted on machine, thus attaining a compact and complete unit.

The press illustrated has bolster area of 36 x 47 in., the distance between uprights being 48 in. It has a 6 in. stroke and is single geared to operate at 60 strokes per minute. The overall height is 142 in. and overall floor space is 79 x 112 in.; the approximate weight, exclusive of motor, being 29,000 lb. Roll feeds of this press handle material up to 12½ in. in width, feeds having maximum feed pitch of 14 in.

New Electrode For Hardfacing

An arc welding electrode designed for restoring worn cutting edges on tools of all kinds which is said to permit savings of 20 to 25 per cent in tool cost is announced by The Lincoln Electric Company, Cleveland, Ohio.

This new electrode, known as "Toolweld," is the product of several years of research and of particular value to all industries using tools. By using this electrode, lathe tools, bits, milling cutters, drills, cutting and forming dies and all other tools which have become worn in service can be given a new and harder cutting edge than has heretofore been possible. Tools can be refaced an unlimited number of times with this electrode.

Also new tools using ordinary steel in place of high-speed steels can be provided with a cutting edge at tremendous savings.

"Toolweld" electrode provides a deposit which is equivalent to high-speed tool steel, and has the advantage of retaining its hardness (55 to 65 Rockwell C) under relatively high temperatures, up to approximately 1000 degrees Fahrenheit.

Motorized Reducers

To meet the demand for greater compactness and economy in self-contained enclosed speed-reducing units, Link-Belt Company, Chicago, Ill., announces a new line of motorized helical-gear reducers.

A standard round-frame motor conforming with National Electrical Manufacturers' Association specifications, is secured firmly to side of reducer housing by means of an adapter casting. The motor, with adapter and motor pinion, may be removed as a unit for inspection or maintenance, without disturbing the alignment of the motor, or of the gears remaining in the reducer housing. All gears are of the helical type, with teeth cut from heat-treated alloy steel. Anti-friction bearings are used throughout.

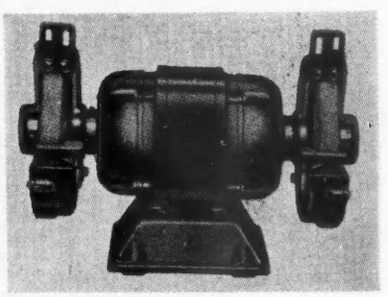
The reducers may be mounted on floor, ceiling or wall, and are available in double reduction for ½ to 75 hp., in ratios up to 38½ to 1, and in triple reduction up to 30 hp., in ratios up to 292 to 1.

Skilsaw Adds Line of Bench and Pedestal Grinders

Skilsaw, Inc., Chicago, Ill., announces a new line of bench and pedestal grinders and combination grinder-buffers both bench and pedestal type. The wide selection of sizes available includes units for intermittent tool shop use and for production grinding and buffing.

Motors in the bench grinders range from 1/6 hp., split phase type or condenser type in the 6-in. size, to 1½ hp., 220-volt, 3-phase type in the 10-in. size.

Motor design, construction characteristics and performance of the line of combination grinder-buffers are identical to Skilsaw bench grinders, excepting that motors in these units are all con-



denser type. This motor can be slowed down in speed and stalled any number of times without damage to motor.

Equipment on the grinders is complete. Guards on the larger models are the enclosed type of heavy, durable metal. Tool rest on all models is adjustable for wear of wheel; and tool rest, as well as guards, can be removed for buffing work. Switch in base, 10 ft. of cord and plugs, one coarse and one fine grinding wheel.

Hydraulic Vertical Surface Grinder

Pratt & Whitney Company, Hartford, Conn., has placed on the market a 14-inch Vertical Surface Grinder with hydraulic table drive, and table speeds from zero up to 100 ft. a minute.

The drive to the spindle is direct geared with the motor up out of the way, and its full power is transmitted to the wheel through a pair of hardened nickel steel spiral bevel gears particularly developed for this drive. The design is such that the drive can handle much more than the standard 30 hp. should the occasion arise.

The wheel is 14 in. in diameter, 1½ in. thick. It is held in a cast iron wheel mount which bolts to the spindle flange. A few minutes is sufficient to change wheels. A strong steel guard surrounds the wheel to prevent damage in case of accident. Wheel truing is accomplished by a built-in device on the end of the table.

The wheel down feed mechanism is the ratchet wheel and pawl type, and produces power feeds ranging from .00025 in. to .005 in. at each end of the table stroke. In addition either a slow or a fast hand wheel feed is engaged by pulling the hand wheel in or out.

The hydraulic mechanism is driven by a separate 5-hp. motor mounted on a pad on the bed on the right rear side. The control valve and lever are on the front of the bed under the operator's hand, and vary the table speed from zero up to 100 ft. a minute. Two adjustable stops are provided for quickly setting of particular speeds if desired.

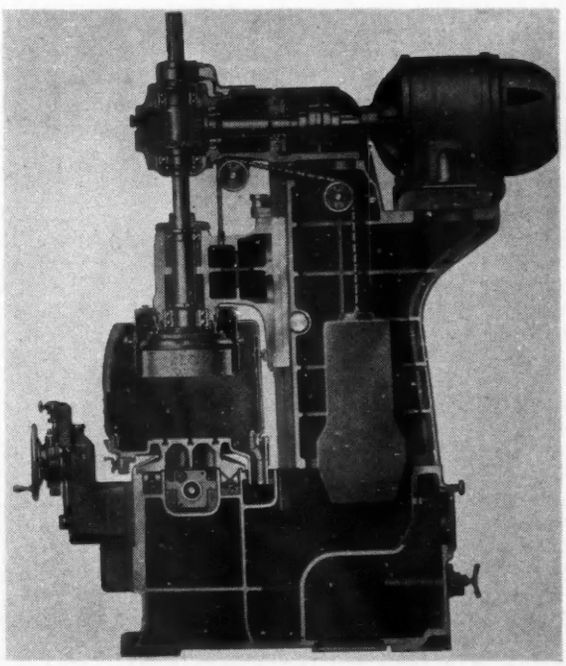
A separate ½-hp. motor drives a built-in coolant pump.

All controls are grouped on the front of the machine and are very simple. Push button control is provided for all three motors, and on top of the same box is the lever for magnetizing or demagnetizing the magnetic chuck. Red lights in the push button box show which way the current is engaged.

The machine weighs 12,000 lb. including the three motors. The table working surface is 12 in. x 36 in. with a maximum longitudinal travel of 45 in. A magnetic chuck is used with a working surface 11 in. x 34 in. The machine occupies a floor space 14 ft. 5 in. long, 7 ft. 4 in. wide.

Pick-proof Automobile Lock

A new automobile lock, claimed to be pick-proof, will be placed on the market shortly by the Dudley Lock Co., 235 W. Randolph Street, Chicago. It is designed to lock both the doors and the steering gear. The lock has a four-edged key which is virtually four keys in one, by means of which four sets of tumblers are operated. This is said to provide an infinite number of key changes and no two Dudley locks are alike. Only the original owner can order a duplicate key by presenting his registration card to the authorized dealer in his community.



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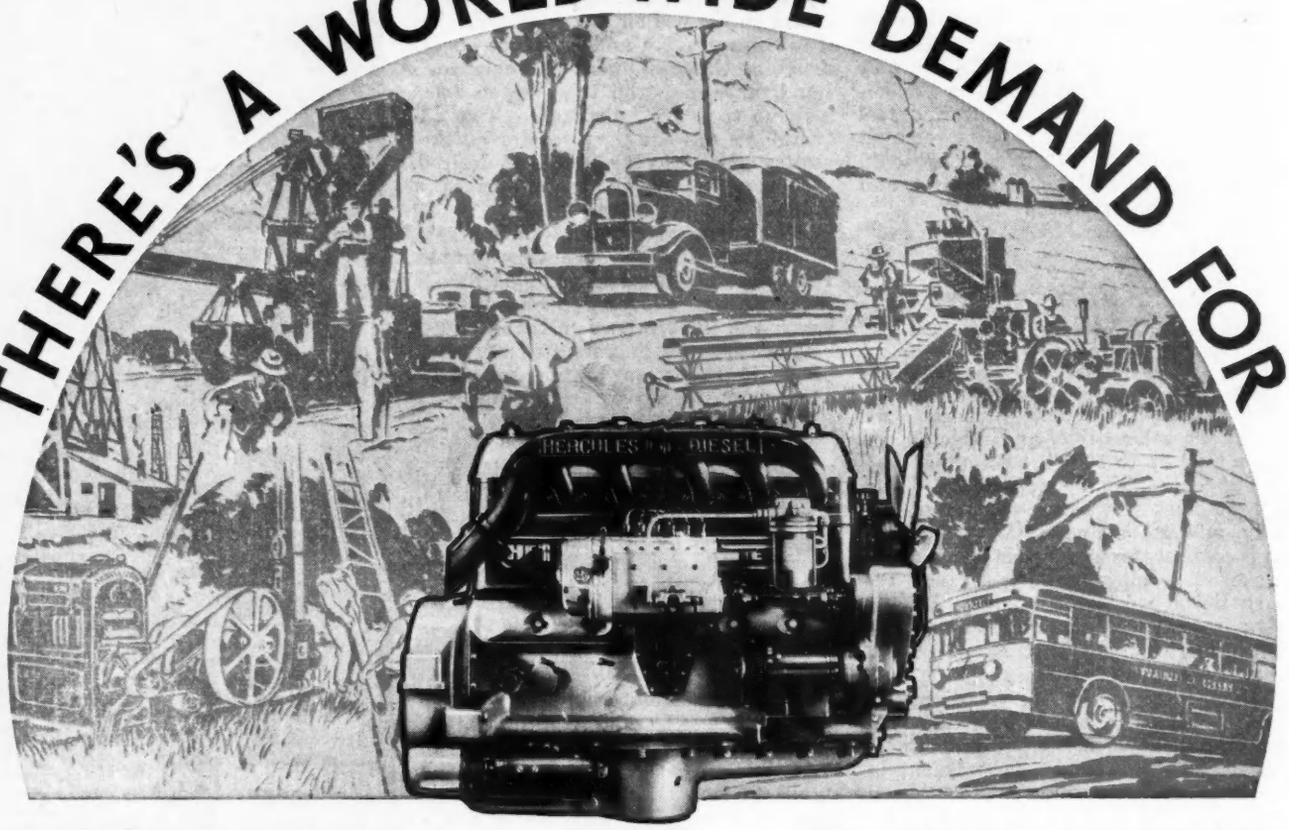

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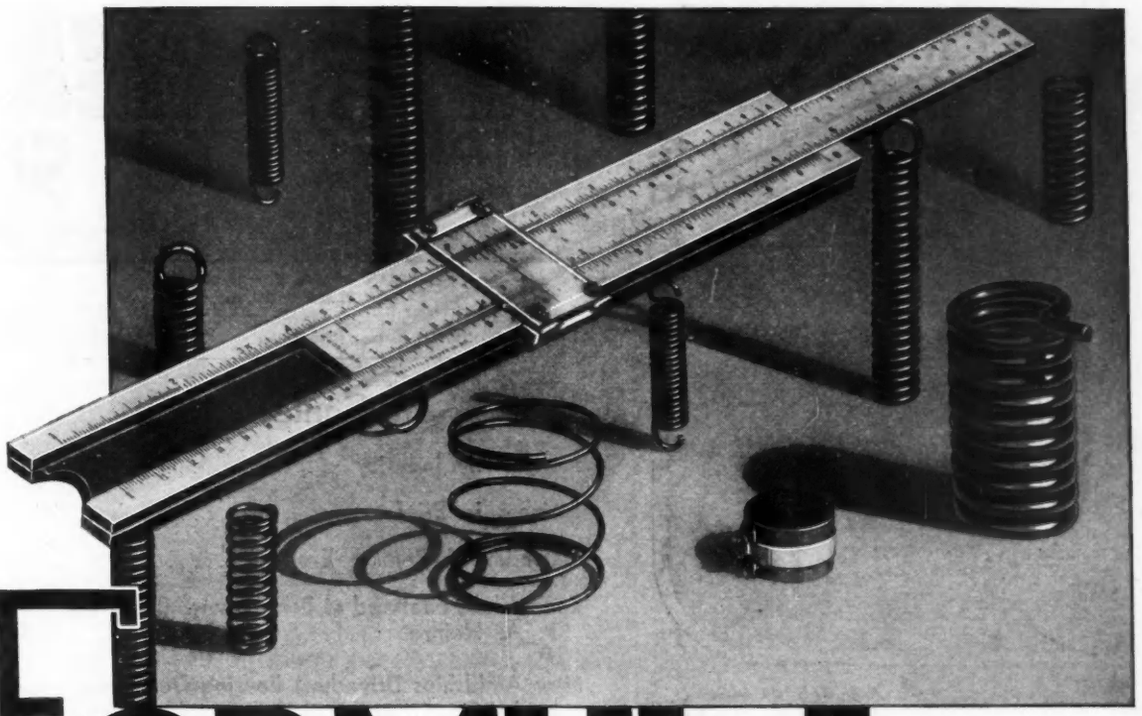

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